

Photographed Specimens
T. eratomis Varies B 309

Type Cat. gracilis
Cotype " " (Cast)

V. clarki

(B entered 1972)

humerus B5580, int., ant.

2 humerus (prox B5329, ulnar, radial

2 humerus B1428, vent., lateral

humerus dist. B4847, radial,

Tarsus B3326, post., lat. ant. 138311

Coracoid, B1739, ventral, int.

Mandible, vent., dorsal, symphysis B?

Scapula B4450, vent.

Tibia B5828 ant. ext.

Carpus B9402, int. ext.

(B entered 1972)

Skull K3158, dorsal

(over)

2
Photographed specimens
Coragyps acidentalis

carpus D9369, int.

humerus D7984, ant

humerus D8076 rad. ~~Isodactylus~~

tarsus ant. " "

Radius F565

ulna D7145, int.

coracoid D7023 dorsal

fibula D9120, ant.

scapula D8965 dorsal

furcula F2050

pelvis D9702 dorsal

sternum D7373 vent

skull F3232, dorsal

Condors

Get size range for each element
of Teratornis, Gymnogyps,
clarkii, Crazygs and Cathartes

Gymnogyps

		largest	hant. surf.
Tassus	B3198	134.2	(131.8)
"	B3670	111.9	109.7
Tibia	B7587	245.0	239.0
"	B3224	214.5	207.8

femur

humerus

carpus

ulna

coracoid

scapula

Teratomis

tarsus

"

tibia

"

femur

"

humerus

"

ulna

"

carpus

"

coracoid

"

scapula

"

~~Sub~~ Coragyps

tarsus

"

tibia

"

femur

"

humerus

"

ulna

"

carpus

"

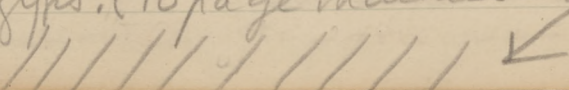
coracoid

"

scapula

"

Turn farther back for
extremes of Cathartes and
Coragyps. (To page marked at bottom)



Modern material available

Uictus gyphus

L.H. Miller no. 218 complete

Sauroscaphus japa

L.H. Miller no. 686 comp. ? (lum. ?)

L.C.M. no. 737 complete

Caryops atratus

L.C.M. no. 716 } complete

L.C.M. no. 228 }

Cathartes aura

Lam #8 complete

Gymnocypris californiana

L.C.M. 269 (very bones & misc.)

L.C.M.

(Body & shells.)

L.C.M.

(Complete, mt of flat)

number of specimens of each element
of *Coryphodiscus*

Tibia

Tarsus

Femur

Humerus

Ulna

Radius

Carpus

Coracoid

Scapula

Sternum

Pelvis

Skull

Cran.

Beak

Jaw

Number of specimens of each element
Gymnagys from La Brea

ulna 339 (148 comp, 65 prox, 166 dist)

scap

humer

humer

ulna 307 (33 comp, 4 neck, 20, 134 prox, 136 dist) also 62 inc. which may be either ulna or radius

coracoid

scap

sternum

pelvis 99 (36 comp, 50 sac, 13 pelvic frags)

skull

cran.

teeth

jaw

radius

Number of specimens of
each element

Ualtran clarki

Fibia 20 (5 comp., 4 prox, ⁹ dist., 2 sh. 15)
Femur 23 (14 comp., 6 dist., 2 prox., 1 shaft)
Humerus

skull 6

crura 2 } one of each of these united
teals 3

jaw 2

Humerus 16 (4 comp., 5 dist., 7 prox.)

ulna 17 (10 prox., 7 dist., no completes)

cra 20

scap 13

stern 7

pelvis 6 ^{or 7} (2 comp., 3 inc., 1 pelvic frag., ~~1 pelvic frag.~~)

carp. 15

radius

Number of specimens
Teratonus merriami
ibia

Series 191 (132 comp, 7 im, 32 det, 20 pup)
Jenny

no. specimens

La Brea Cathartes

Skull - ^{x2} 2 cranium, ^{D7532} 3 rostra

Stemum 8

Furcula 9

Mandibles 2 comp, 2 rami, 2 symphyres

Scap. 4

Radius 3

Tarsus 12

Carpus 22 (+1)

Fibia 18

Ulna 8

Femur 16 (+5)

Cora 25

Humerus 20 (+5)

Pelvis 1 (+2)

note: - casts run about 0.1 mm, ^{- to 0.3 mm} larger

Cathartornis gracilis

	type	cast	conyo
Br. shaft mid	11.2 (11.4) ^{shaft}	11.2 (11.5)	
Depth shaft ab. mid	11.3	11.3	
Depth mid. fork	18.9 ^{inner side}	19.1	
" inner	15.0 ^{inner side}	15.3	
" outer	—	13.0 ^{inner} 15.7 ^{outer}	
Gr. prox. end	27.6 ^{across anteriorly} 25.7 ^{greatest} 25.0	27.8 cast 29.1 cast 24.4 cast	
Depth prox. end	23.7	24.7 cast	
Length	129.8 ^(cast)	—	
Greatest depth	131.4 (131.9) ^(cast)	—	
Breadth dist. end	—	29.3 ^(cast) (29.5)	
prox. to ^{dist. edge of} fork	26.2	26.2 cast	
dist. ^{dist. edge of} fork	105.2 ^(cast) 104.6	105.6	
Gr. mid. fork	11.6 (11.8) ^(cast)	—	
Gr. int. fork	—	8.0 ^(cast) (8.2)	
Gr. hypotarsus	16.8 ^(cast) (17.1)	—	
ht.	10.8 (10.9)	—	

• • *Exbrems*

Coragyps occidentalis

tarsus max. 88.7

" min. 78.3

tibia max. 150.9

" min. 138.2

femur max (from distal facet) 101.9

" min. 82.5

humerus max 154.9

" min. 143.3

ulna max. 180.0

" min. 156.8

carpus

scap max 18.2

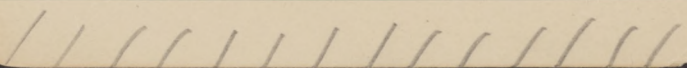
" min 17.0

coracoid maximum 70.2

" minimum 65.5

radius max. 162.6

" min. 150.7



modern ?

Coragyps atratus ?

Tarsus ✓ max. 86.1

" min. 82.7

tibia ✓ max. 146.6

" 140.0

peris ✓ max 87.3 (palm line facet

" 83.9 (" " ")

humerus ✓ max 142.0

" min 133.3

ulna max. 166.1

" min. 151.5

carpus ✓ max 76.0

"

coracoid ✓ max 62.2

" 59.7

scap ✓ max. 17.0

"

radius max 151.6

" min 144.0

Coragyps occidentalis

number of specimens of each element

tarsus 359 (258 comp., 80 tars., 10 prox., 11 dist.)

genu

tibia 239 (89 comp., 14 tars., 100 dist., 36 prox.)

skull

cranium

beak

jaw

humerus

ulna

carpus

coracoid

scapula

sternum

pelvis

Cathartes aura

No. of specs. of each element

taurus

fibra

ferus

Biocientific Terminology

Words from Latin & Greek stems

Donald M. Ayers

Paperback

Univ. Arizona Press 1972

Vertebra # 4638 from la. 310 ^{Tequiguina}
is closest to RLB 69346 assigned
to Breagyps.

Differs from Gymnogyphs

- ① Posterior facets are almost directly
anterior-posterior in position (Gymnogyphs)
They slant in toward centrum
- ② Shape of facet posterior on centrum
larger than in Gymnogyphs & facing
more directly posterior not so dorsally
as in Gymnogyphs
- ③ In side view centrum is depressed
beneath ant. facets so that edge
of bone borders canal posteriorly
laterally.
- ④ Small spur of bone occurs very close
to ant. upper facet (almost directly
below) whereas in Gymnogyphs it
is more anterior in position (about
midway between ant. facet & post.
zygoprophysis)
- ⑤ Dorsal spine relatively broader at base
and less spurious in its projection
(shorter & broader)

Gymnogyps ^{amplius} *tibialis*
19628 (old # 1344)

✓ B2626

✓ B1958

✓ B7587

B4982

✓ B1519

✓ B2328

V2 used May 10, 1972 (✓ in
corner used in March)
only

Brachyops tibialis

Outer cranial crest long (extends below level of
inner cranial crest)

with ridge continuing down below

G. calif #141 length tibia-tarsus

213 mm articulation prox #141 tibia

217.8 mm to crenulated crest " "

max angle 244.2 gr + 238 to art's

mm " 215 208

check fibial length for Table 10

J S & Bull 1952

Law Mar Apr
at mus

REFERENCE CATALOG—FOSSILS.

LOS ANGELES MUSEUM
LOS ANGELES, CALIFORNIA

SCIENTIFIC NAME _____ CASE NO. _____

COMMON NAME _____ DRAWER NO. _____

Gymnopus calif. specimens

✓ Complete except tibia 141 ♀ ad
(sternum rectus)

sternum pelvis, femora furcula 375
furcula only 212

~~wing bones coracoids, scaps. furcula 1050~~
+ broken sternum (pathol.)
+ furcula

lea. wing bones, scaps, coracoid 269
✓ broken sternum, furcula attached
carp. detached M I, venter
1050

Humeral, ulnae, radii
sternum, pelvis, furcula, coracoids
scapulae, R femur + L prox femur
1 prox humerus, venter, ribs 7 in 371

same as above (minus prox femur) 1052

2 broken ^{ant. good on each} sterna, 4 coracoids
2 pelvis, 1 ^{good} furcula, 4 scaps, 2 femora
1 broken furcula, 1 prox femur, venter 31

sternum, pelvis, pathol. furcula ribs 7 ad
2 femora, 2 coracoid, 2 scaps, venter 302

articulated pelvis, sternum, coracoids,
scaps. furcula, femora, ribs, venter 139

REFERENCE CATALOG—FOSSILS.

LOS ANGELES MUSEUM
LOS ANGELES, CALIFORNIA

SCIENTIFIC NAME _____ CASE NO. _____

COMMON NAME _____ DRAWER NO. _____

Teratornithidae

The family Teratornithidae was originally established (Miller, 1925, p. 87) in order to provide proper allocation for the single species Teratornis merriami. Subsequent study of the type tarsometatarsus of Cathartornis gracilis, however, has led to the conclusion that the latter species, too should be included in this family, and in fact in the genus Teratornis.

The diagnostic characteristics of the family Teratornithidae ^{are} ~~are~~ presented by Miller (op. cit., p. 94) ^{are} as follows:

l "Elongation and attenuation of the ~~Ulna~~ ^{radius} and metacarpus.

Ruggedness of the humeral head.

Broadening and shortening of the sternum

Weakness and openness of the furcula.

Relative weakness of the posterior limbs.

Reduction of the trochanter of the femur.

Reduction of the tibial crests.

Columnar character of the tarsometatarsus

Compression and vaulting of the beak

Close approximation of the maxillo-palatines.

Lateral and backward extension of the postauditory prominences.

Reduction of the cerebellar region.

Elliptical form of the foramen magnum."

For the purpose of better clarifying the position of the form now known as Cathartornis gracilis, ^{the type of which is a tarsometatarsus} the present writer has ~~paid~~ ^{element} particular attention to further details of the ~~tarsometatarsus~~ ^{additional} and believes that there are two ~~further~~ characters worthy of family distinction.

1) The facet for metatarsal I faces directly posteriorly, while in the Cathartidae it is lateral as well as posterior in direction.

2) Anteriorly the excavation of the shaft just below the head blends imperceptibly into the head region and lacks the peculiar vaulted appearance at its proximal border that is found in the Cathartidae.

In both of these characters C. gracilis agrees with the Teratornithidae.

Teratornis gracilis (Miller)

Cathartornis gracilis Miller, Univ. Calif. Publ. Geol., vol. 6, p.14, 1910.

The first description of this species was based upon two tarsometatarsi (type and cotype) in the University of California collections. Since then, Miller (1925, p. 84) has recorded the presence in the Los Angeles Museum collections of two similar tarsometatarsi and has referred to this species a tibiotarsus, skull and carpometacarpus, from the Los Angeles material, as well.

Unfortunately the two tarsometatarsi were not numbered, nor in any way marked, so that it is impossible to be certain of the exact specimens to which Miller referred. However, he has since assured the present writer that now that the greater amount of material available has shown the degree of variability to be expected in *Teratornis merriami*, he is convinced that the bones were of young individuals of that species and that they are now among the specimens so assigned. ^{This is further} ~~That text is~~ attested to by the fact that there are found among the specimens of *T. merriami*, certain bones (numbered since Miller's paper in 1925) which in slenderness closely approximate *gracilis*, but which are ^{now} unquestionably assigned to *merriami*.

With the close approach of *Teratornis merriami* to *gracilis* in its range of variation, a question was raised regarding the specific identity of *gracilis*. The ^{and cotype} type specimens of that species were secured from the University of California, and, with the kind cooperation of Dr. Miller, a careful comparative study of *Teratornis merriami* and *gracilis* has been made. This study has resulted in the conclusion, to which we both agree, that *gracilis*, though markedly similar to *T. merriami*, enough so, certainly, to indicate generic identity, is sufficiently distinct to warrant its being maintained as a separate species. The main characters upon which this conclusion is based are ^{listed} ~~presented~~ below

Tera

The first description of

In these lists the characters are divided into those of generic importance (which are common to both *merriami* and *gracilis*) and those which have only specific value (which separate these two species).

Generic Characters

Inner ridge of hypotarsus more prominent than outer

Hypotarsus quadrangular

Hypotarsal black set well toward outer side of head and separated from head by wide, smooth depression (as seen from proximal end).

Intercotylar tuberosity relatively inconspicuous.

Tubercle present on outer side of proximal anterior excavation just below margin of external cotyla, and another one on opposite side of excavation a bit more proximal and more median in position.

Plantar foramen low and connecting with external intertrochlear space directly or by small groove, in nearly all specimens of *merriami* though some are bridged. The cotype of *gracilis* has the small groove; the type is broken in this region.

Specific characters

merriami

Shaft flattened posteriorly

Breadth of shaft averaging about 10% of length of bone (smallest ratio, 9%)

Shaft less deeply and extensively excavated anteriorly (though closely approximating *gracilis* in some specimens)

Head more symmetrically flared (some individuals flare on internal side to a much greater degree than the type, but none quite approach *gracilis*)

gracilis

Shaft convex posteriorly

Breadth of shaft only 8.5% of length of bone

Shaft deeply excavated anteriorly, excavation continuing on lesser scale into distal foramen.

Head more developed on internal side than outer, the flare beginning further down the shaft and extending laterally to a relatively greater degree than in *merriami*.

Specific characters (continued)

Hypothetical points -- based upon the cotype of *gracilis*

Gracilis with more symmetrical distal end than *merriami*, due to greater flare on outer side, equalling the one on the inner side.

Gracilis with relatively narrower distal end. Note: this can only be estimated by comparing the breadth of the distal end with the length of the bone to the tubercles for the tibialis anticus ^{as} since the cotype of *gracilis* is incomplete. Since the distance to the tubercles relative to the total length of the bone, as measured in the type specimen of *gracilis* agrees with similar measurements in *merriami*, however, it would seem that the observation regarding the relative narrowness of the distal end is accurate.

Having concluded that the ~~type~~ tarsometatarsus of *gracilis* ~~is~~ is similar to that of ~~Teratornis~~ ^{the species} *Teratornis* and is thus a teratornithid rather than a cathartid, it is immediately obvious that the skull assigned to *gracilis* (Miller cannot be of that species after all. A brief comparison with *Teratornis* shows the dissimilarity of the two; the smaller skull is not found to agree with *Teratornis* in any of the characters described by Miller for that genus (1909, U.C. Publ. Geol. 5, p. 307 and 1925, Carn. Inst. Wash. Publ. 349, p. 87). On the other hand it shows definite similarities with the cathartids, so much so, in fact, that the cranium alone might at first glance be mistaken for *Gymnogyps* or *Vultur*.

The same resemblance to the Cathartidae and disagreement with the Teratornithidae is found in the tibiotarsus and carpometacarpus which had been referred to *gracilis*¹. Apparently, then the two tarsometatarsi in the University of California collections represent our sole knowledge of the species *T. gracilis* to date. In view of our failure to find tarsometatarsi of this species in the Los Angeles Museum collection, it is probable that further information must be looked for in the University collections.

¹ Further details are presented in the discussion of the species *Brachypteryx alarkii* which follows.

Fossil Cathartids and Teratornithids
from Other Localities

Members of the family Cathartidae are represented in the fossil list as early as the Oligocene. From beds of Oligocene age in Colorado Wetmore (Proc. Colol Mus. Nat. Hist., 7, 1927, p. 5, figs. 5-14) has described two species, Phasmagyps patritus and Palaeogyps prodromus. None is known from the Miocene; Palaeoborus umbrosus from the Miocene of New Mexico, though frequently assigned to the Cathartidae formerly, is more properly assigned to the Aegyptiine subfamily of the Accipitridae (Howard, 1932, pp. 70-73). ^{Two species are recorded one from} From the Pliocene, ^{described by} of Kern County, California Miller (Condor, 33, 1931, p. 70, fig. 16) ~~has described~~ Sarcoramphus kernensis. ^{Several} ~~Among~~ ^{are the} several species are known from various deposits in the Pleistocene. ~~Of these, four are known at Rancho La Brea; the other three are~~ Coragyps shastensis from Potter Creek, Samwel and Hawver Caves, California (Miller, U.C. Pub. Bull. Dept. Geol., 6, 1911, p. 388, fig. 1), ~~and~~ Gymnogyps amplus from Samwel Cave, California (Miller, op. cit., p. ^{recorded by} and Coragyps atratus, the modern Black Vulture which Wetmore (1931, p. and from Guadalupe Cave, N. M. (Wetmore, has recorded from Florida. ^{the other four species are known from P.L. Brea and these} Vultur clarki is known only from La Brea, but ~~the other~~ Gymnogyps californianus, Cathartes aura and Coragyps occidentalis have been recorded from other ^{also several} ~~Pleistocene~~ Quaternary deposits (Pleistocene or early Recent), as follows: Coragyps occidentalis from Conkling Cavern, New Mexico (Howard and A. H. Miller, 1932, p. and Carpinteria, California (L.H. Miller, 1932, p.); Cathartes aura from Florida (Wetmore (1931, p.) Shelter and Conkling Caves, ~~New Mexico~~, (Howard and A.H. Miller, 1932, p.), and Guadalupe Cavern (Wetmore 1932, p. 142), New Mexico, Potter Creek, Samwel and Hawver Caves (Miller, 1911, p. 387), Carpinteria (Miller, 1931, p. 364), and San Pedro (Miller,), California; Gymnogyps

californianus from Florida, (Wetmore), Conkling Cave (Howard

① Described as Sarcoramphus with comparisons to ~~Sarcoramphus~~ ^{Gymnogyps} ~~gypsius~~ ^{now Vultur gypsius}

and one from Bolivia,
Baltusgypsus (Condol),
and Vulture fossils from the Miocene of La Brea

and Shelter Cave (Howard and A.H. Miller, 1932), Guadalupe Cave (Wetmore), New Mexico, Mule Ears Peaks, Texas (Wetmore, Condor 45, 19) Gypsum Cave, Nevada (Miller and Carpinteria, California (Miller

Members of the family Teratornithidae have been recorded of North America only from the Pleistocene. Outside of Rancho La Brea, Teratornis merriami ~~texanensis~~ has been recorded from Florida (Wetmore, as well as Carpinteria and McKittrick, California (Miller Cathartornis gracilis, which the present writer is now assigning to the Teratornithidae, is known only from Rancho La Brea.

Specimens resembling *Coragyps atratus* have been taken at Auvergne, France. Other than this occurrence, however, all members of the two families under consideration are confined to America.

Two described
Fossil cathartids have been ~~reported~~ from South America, ~~see~~
~~see~~: *Sarcorhamphus patruus* (Lonnberg, 1902, p. 4) from Bolivia, *Sarcorhamphus fossilis* (Moreno and Mercerat, 1891). Though the very members of this family are now confined to America, one small fossil form has been described from ~~the~~ the Upper Eocene-Lower Oligocene of Quercy, France (Gaillard, said to 1908, pp. 41-44). Several skulls, resembling *Coragyps atratus* were reported from Auvergne and Velay, France by Jourdan (1857, p. 344) According to Lambrecht, (p. 397), however, this record should of the age of the publication and ~~be~~ not be given too much credence, in view of the fact that there was or illustration no description given.

Smith Creek Cave.

Condor

Tarsus

~~Similar to Breagys clarki and distinguished from~~
~~Synsphyx in more abrupt flaring of prox. end and from~~
 shaft, $\frac{2}{3}$ greater ^{ant-post} depth ~~of shaft~~ ^{less}, transverse head to shaft,
~~narrower distal end~~ more posteriorly placed $\frac{2}{3}$ int.
 trochlea, similar to B. clarki & distinguished from
Vultur gryphus in narrow ant. meta. furrow,
 backward thrust of outer margin of shaft, the conspicuous
 inner hyporidge on one specimen in which this ridge is
 complete, & abrupt post. deflection of int. metatarsal.

One point of possible difference from clarki is the
 apparently greater depth of ^{ant.} furrow particularly
 noticeable in 2 or 3 of the specimens, and possibly smaller

~~shaft~~ ⁶² ^{depth} ^{int.}
 shaft 11.4 9.6 - 8.8

dist. sh. 12.3

depth prox. int.

11.1 ext

21.2 and 20.8

18.7

Teratornis

In order properly to allocate Cathartornis gracilis, the type of which is a tarsometatarsus, we are concerned primarily with the characters of this element in the genus Teratornis.

The present writer has studied all of the characters listed by Miller for gracilis (1910, pp. 14-15) and merriami (op. cit., pp. 16-18), checking each ^{of the latter} ~~one~~ with the large series of Teratornis merriami now ~~at~~ available. It is evident that certain characters presented for the type of merriami, are inconstant when checked through the larger series of specimens. Therefore, the list given below does not in all respects agree with Miller's original description. The present list is divided into characters which appear to be of generic importance (~~in~~ which are common to both merriami and gracilis) and those which have only specific value (which separate the ~~se~~ two species).

Generic Characters

Inner ridge of hypotarsus more prominent than outer

Hypotarsus quadrangular

Hypotarsal black set well toward outer side of head and separated from head by wide, smooth depression (as seen from proximal end).

Intercotylar tuberosity relatively inconspicuous.
present

Tubercle ^{present} on outer side of proximal anterior excavation just below margin of external cotyla, and another one on opposite side of excavation a bit more proximal and more median in position.

Plantar foramen low and connecting with external intertrochlear space directly or by small groove, in nearly all specimens of merriami though some are bridged. The cotype of gracilis has the small groove; the type of gracilis is broken in this region.

Specific Characters

merriami

gracilis

Shaft flattened posteriorly

Shaft convex posteriorly

Shaft averaging about 10% of

Table 2
Revised 1951

Characters of the Tarsometatarsus of Teratornis

Family characters (in which *T. merriami* and *T. gracilis* agree)

The distal end is less obtusely developed on the inner side than in the Cathartidae, and is thus more nearly symmetrical. The facet for metatarsal I faces directly posteriorly, while in the Cathartidae the direction is lateral as well as posterior.

The shaft is more columnar with a more abrupt flare proximally.

Anteriorly the excavation of the shaft just below the head blends imperceptibly into the head region and lacks the peculiar vaulted appearance at its proximal border which characterizes the Cathartidae.

Generic characters (in which *T. merriami* and *T. gracilis* agree)

The hypotarsus is quadrangular; the inner ridge is more prominent than the outer, the whole block is set well toward the outer side of the head and is separated from the head by a wide, smooth ^{slightly depressed area} depression (as seen from the proximal end).

The intercotylar tuberosity is relatively inconspicuous.

There is a tubercle on the outer side of the proximal anterior excavation just below the margin of the external cotyla, and another of similar size on the opposite side of the excavation a bit more proximal and more median in position.

The plantar foramen is close to the distal end and connects with the external intertrochlear space directly or by a small groove in nearly all specimens of *merriami* though some are bridged over. The cotype of *gracilis* has the groove; the type is broken in this region.

Specific characters (in which *T. merriami* and *T. gracilis* differ)

<i>merriami</i>	<i>gracilis</i>
-----------------	-----------------

Shaft flattened posteriorly
Shaft averaging 10% of length
(narrowest shaft 9.0%)
Shaft less deeply and extensively
grooved anteriorly (though some
specimens closely approach *gracilis*)
Head more symmetrically flared
(Note: some individuals have much
greater flare on internal side than
type but do not quite equal *gracilis*)

Shaft convex posteriorly
2 only 8.5 % of length
Shaft deeply excavated, excavation
continuing (on lesser scale) into
distal foramen.
Head more developed on internal
side, the flare beginning further
down the shaft and extending
laterally to relatively greater
extent.

Specific characters continued

Hypothetical characters (based on cotype)

The distal end of gracilis appears more symmetrical than merriami, due to greater flare on outer side, equalling the one on the inner side.

Gracilis appears to have a relatively narrower distal end. This can only be estimated, however, by the ratio with the distance to the tubercle for the tibialis anticus. However, the ratio of this distance to the length of the entire ~~merriami~~ bone, which may be calculated in the type of gracilis, agrees in merriami and the type of gracilis.

All other differences, which Miller recorded between the types of merriami and gracilis have been found inconstant when a large series of merriami is observed.

* include
symmetry
in the for
comparison

gracilis

merriami

1. Extreme slender part of shaft
--- strongly grooved throughout its length
edges of trough converted into narrow ridges
2. Shaft moderately excavated
lateral margins appear as smooth rounded ridges
3. Inner ridge of hypodarsus much more prominent
The inner hypodarsal ridge is produced to a slightly less degree than shown in *C. gracilis*. The inner part of the bone from this point of view is very much like that of *gracilis*.
4. Shaft of tarsus relatively narrow & thick
None quite so narrow or so thick.
5. The excavation in front below the head is very deep, abrupt & subcircular. The excavation of the shaft just below the head is deep & almost perfectly elliptical.
The head reg. is excavated much as in *C. gracilis* but the cavity is smaller & more nearly circular.
(note: not constant - many resemble *gracilis*)
6. Intercoxylar tuberosity relatively inconspicuous
Intercoxylar tub. very inconspicuous
19. The tuberosity is scarcely evident from this direction
The intercoxylar tub. is almost invisible
12. The intercoxylar tuberosity is very low & flat with gradual slopes in all directions
The intercoxylar tub. is low and mound shaped.
7. Tibial facets subequal with their longest diameters nearly parallel to the sagittal plane
both facets have their longest axes almost parallel with the sagittal plane
8. Hypodarsal black set well toward the outer side of the head.
Note: Same here.
9. Hypodarsus separate from head by wide, smooth depression, as seen from proximal end.
The depression between the head proper and the hypodarsus is a very broad shallow and smooth area marked off on all its borders by raised ridges
(note: not constant)
10. Shaft remains nearly uniform in diameter until very near the head, where it suddenly expands
Note: Same here
11. This expansion however is made on the inner side, a condition which turns the center of the head far to the inner side of the axis of the shaft & gives this end of the bone a markedly goose-like appearance
Head almost symmetrical on shaft, in the head region, the curvature is almost equal on both sides.

13a. The attachment of the tibialis anterior appears as a pair of distinct papillae

* 13b below which the trough in the shaft is very deep and almost "C" shaped in cross section.

14 The edges of the trough are thus converted into very narrow ridges.

15 The furrow continues down the shaft to merge with the distal foramen

* There are no intermuscular lines evident on the ant. face, tho the shaft here shows no corrosion (Note: intermuscular lines are present but very faint)

16a The shaft widens very gradually to the foot

16b and cotype 12600 shows the two sides to be very nearly symmetrical in curvature. This cond. is in marked contrast with the asymmetry of the proximal end & the cond. of the foot in *Shuco*, & *Gymno*.

17a The two trochleae remaining on the type specimen are much more slender than in the existing condors 11.6 to 19.9 (mid. troch. trans. to sag.) (5890)

17b In their anteropost. planes they exceed both the above mentioned species but the degree of lateral compression is very great.

18a The post. surf. of the shaft presents an aspect very similar to *Saurangulus clarkii* except that it is ^{quite} more narrow, more gradually tapering & the intermusc. line is poorly defined

18b The surface bet. the 2 long. limiting crests is strongly convex as far down as the distal foramen

20 The outer articular facet is but little if at all in area of the inner one ~~not~~

21 ~~not~~ facets have their long. axes almost parallel with the sagittal plane

The attachment of the tib. ant. takes the form of two papillae, the outer elongate, one placed slightly above the inner, more nearly circular one

Below these papillae the shaft is moderately excavated

The lateral margins appearing as smoothly rounded ridges

(Note: some variation here) The outer ridge becomes more sharply angled as it nears the mid. of the shaft, & depicts the fact that the ant. furrow here becomes practically ~~straight~~ ^{practically straight} & passes thence as a definite ridge almost straight to the outer border of the distal foramen

Further marking of the face of the bone is limited to a single longitudinal intermuscular line which begins on the outer end of the outer tubercle of the tibialis anterior, passes rather quickly to the median line & reaches the median line at about the middle of the shaft to pass over to and occupy the inner border, where it disappears at apt. about $\frac{1}{2}$ the way down the shaft.

From this point (middle of shaft) the enlargement in either direction is quite gradual

Foot rotated inward; inner toe much in rear of outer & reaching almost same level as middle toe narrow, pointed foot (disjunct from *G. gracilis*).

The curvature in the inner & dept. the foot region is slightly greater than on the outer side.

13.2 & 19.8 (trans. & sag. of mid. troch.) (6690) X

17a Note: Some terry as narrow

as *gracilis*

17b Note: ~~terry~~ may be less ant. pointing but hard to check; rel. to dist. end, mid. & int. high are certainly less deep but dist. end possibly greater.

22, The depression posterior to the tubercle scarcely evident

The depression which commonly appears just posterior to the tub. cannot be definitely entered.

23

OK

24 Note: No here in this reg. but area surrounding similar in shape to Tera as tho it were present

Groove middle tubercle not in sagittal plane. This char. varies

To the outer side of the cavity just below the margin of the outer art. facet, there appears a large horned headed tubercle

25. Note: Present here too

To the inner side of the cavity and at a slightly lower level than the upper limit of the cavity there appears a small, sharp papilla

26. Note: Same here

The narrowest place in the shaft is at just about the middle joint

27.

OK

The tubercles reach more nearly the same level than many of the species hitherto discussed. The inner tubercle in fact descends almost to the same level as the middle one.

Note: This char. varies & some are just like gracilis.

28. Note: same here

The general profile at the head (post. view) is at right angles to the axis instead of being raised at the inner border.

29. Note: Contour present indicates presence of similar tubercle here. The lateral contour is identical but can't tell about height

Externally a sharp break in the profile is produced by a high and pointed tubercle situated at the poster. ext. part of the outer art. facet

30. Note: The var. in Perry & the restoration of C. would equalize the 2.

The hypodermis is slightly lower than in C. gracilis. This char. varies

31. Note: broken here but shape exactly like same Perry

Unlike the forms previously described the lower border of the hypodermis does not merge into the longitudinal ridge at the back of the shaft.

Its distal margin is a well-defined transverse ridge elevated distinctly above the median length. ridge of the shaft.

32. Note: quadrangular here also

Instead of being roughly triangular the hyp. dermis is more nearly quadrangular. The limiting ridges & intersegmental lines are much the same as in C. gracilis.

Specific Characters

merriami

Shaft flattened posteriorly

^{Breadth 2}
Shaft averaging about 10 % of length of bone (smallest ratio, 9.0%)

Shaft less deeply and extensively excavated anteriorly (though closely approximating gracilis in some specimens)

Head more symmetrically flared (some individuals flare on internal side to a much greater degree than the type, but none quite approach gracilis)

gracilis

Shaft convex posteriorly

^{Breadth 2}
Shaft only 8.5 % of length of bone.

Shaft deeply excavated anteriorly, excavation continuing on lesser scale into distal foramen.

Head more developed on internal side than outer, the flare beginning further down the shaft and extending laterally to a relatively greater degree than in merriami.

Hypothetical points -- based on the Cotype of gracilis

Gracilis with more symmetrical distal end than merriami, due to greater flare on outer side, equalling the one on the inner side.

Gracilis with relatively narrowed distal end. Note: this can only be estimated by ~~the ratio of the distance between the~~ comparing the breadth of the distal end with the length of the bone to the tubercles for the tibialis anticus, since ^{the cotype} gracilis is incomplete. Since the distance to the tubercles relative to the total length of the bone, as ^{of gracilis} measured in the type specimen, agrees with similar measurements in merriami, however, it would seem that the observation regarding the relative narrowness of the distal end is accurate.

~~In view of the above observations regarding the characters of gracilis as compared with~~

Clarki

tarri

Gryphus

- 1) Tuberosity cut away at + almost straight profile rear more abruptly (81%) fore + aft on side view.
- 2) Much shorter: width (100%) less stocky bone
- 3) Outer cotyla dropped to less degree below tuberosity (84%) further down
- 4) Inner tuberosity likewise
- 5) These two (3+4) give an effect toward Teratomis
- 5) - Away from Teratomis
- 6) - Scar of Tib. anticus is farther down shaft. (100%)
- 6) - Scar not so far down shaft
- 7) Outer margin of Anterior aspect thrust backward (100%)
- 7) Outer margin not thrust back
- 8) Inner cotyla more elongate dorso-ventrally (82 1/2%)
- 8) more nearly circular
- 9) - Outer hypotarsal furrow wider + shallower (95%)
- 9) Outer furrow narrower and deeper.
- 10) Inner toe relatively larger + nearer level of middle toe (100%)
- 10) Inner toe smaller + raised
- 11) Outer hypotarsal ridge longer (50%)
- 11) - not so long

$$\begin{array}{r} 1208 \overline{) 1040.0} \\ \underline{9664} \\ 7360 \end{array}$$

$$\begin{array}{r} 1187 \overline{) 960.0} \\ \underline{9496} \\ 1040 \end{array}$$

$$\begin{array}{r} 1170 \overline{) 1040.0} \\ \underline{9360} \end{array}$$

$$\begin{array}{r} 1157 \overline{) 900.0} \\ \underline{8307} \\ 6910 \end{array}$$

$$\begin{array}{r} 1208 \overline{) 870.0} \\ \underline{8456} \\ 2440 \end{array}$$

$$\begin{array}{r} 1170 \overline{) 880.0} \\ \underline{8120} \\ 6800 \end{array}$$

$$\begin{array}{r} 1272 \overline{) 880.0} \\ \underline{7832} \\ 11680 \\ 8904 \end{array}$$

$$\begin{array}{r} 1372 \overline{) 960.0} \\ \underline{9604} \\ 1960 \end{array}$$

Tarsus

The series of 26 tarsi of V. Clarki was examined and compared with the Recent V. gryllus of which ~~living~~ species but two individuals were available. These two bones appear to represent one young and one adult individual. From these Recent bones the fossil specimens differ 100% in four characters as follows:-

1 - The bone as a whole is much shorter and stouter

2 - The scar of the tibialis anterior muscle is farther down the shaft.

3 - The outer margin of the anterior face of the bone is thrust backward in the upper third of the shaft

4 - The inner toe is relatively larger and nearer the level of the middle toe

Other differences hold true in from 84% to 96% of the fossil material but break down in a study of the whole series so have been discarded.

Skull

Material available. One complete specimen of cranium and rostrum united, one cranium, and two rostra.

Characters.-- The characters of the skull have been presented by Miller (1925, p. 85-86). They are reviewed here, however, with a few changes, and compared with the characters of each of the other genera of the ~~xx~~ family.

The most noticeably distinctive feature of this skull is the long slender beak, with elongated narial openings. In general appearance this beak is similar to Coragyps though of much larger size and with more evenly rounded posterior borders of the nares.

The detailed characters ~~fixxx~~ are as follows: (1) Well-marked rise in the rostrum anterior to the nares as in the other genera of the family with the exception of Gymnogyps; (2) basilar tuberosities (of the basitemporal plate) developed to a degree similar to Gymnogyps, though terminating less knobily (development of processes greater in Vultur and less in the other three genera of this family); (3) occiput high, as in Gymnogyps; (4) lines bounding occiput ~~striag~~ straight-sided as in Gymnogyps and Vultur (more rounded in the other three genera); (5) lacrymal longer antero-posteriorly at its dorsal edge than in other genera, with stout, blunt process extending laterally from its posterior portion (this process slender and pointed in Vultur and Gymnogyps and curving to extend ~~for~~ some distance posteriorly in the latter; lateral projection in Sarcoramphus, Coragyps and Cathartes scarcely deserving name of "process"); ~~(5)~~ The character of the nasal septum has been ~~rep~~resented under the discussion of the genus.

Vultur clarki

Mandible

Material available:-- Right and left rami, possibly of one individual, and one symphysis with portion of right ramus.

Character.-- 1, Two well-defined post-articular processes as in Gymnogyps and Sarcoramphus, but closer to the former in that the outermost process is noticeably more developed than the inner; inner process distinct in being sharply pointed; 2, inferior border of ramus at articular end straight, not curving downward at outermost post-articular process as in Gymnogyps and Vultur; 3, symphysis longer and narrower than in Gymnogyps, appearing closer to Coragyps or Vultur.

^B
Labreagyps, new genus

Type *Vultur clarki*
After a careful study of each of the principal elements assignable to *Vultur clarki*, it has become evident that this species is no closer to the genus *Vultur* than is *Vultur* to *Gymnogyps* or *Gymnogyps* to *Sarcoramphus*. Particularly is this true of the skull, which, for this very reason, was originally ~~not~~ assigned to ~~this~~ *Teratornis* ~~species~~, but to ~~*Cathartornis*~~ *gracilis*. However, as we have said earlier in this paper, the characters of the skull are definitely ~~and do not necessarily agree with the Teratornithid of which *gracilis* is undoubtedly a member~~ *cathartid*. Since the original discovery of skull no. 3158, an additional cranium and two rostra ^{similar to no 3158} have been found. These represent the only skulls of large cathartids, other than *Gymnogyps*, in the Los Angeles Museum collection, and they are now ^{therefore} unhesitatingly assigned to *Labreagyps clarki*, ~~the latter being the only large~~

The detailed characters of the skull will be discussed under the species, but one character, which appears to be of particular generic importance should be cited here.

This is the characters of the nasal septum. With the exception of the two species of *Coragyps*, each one of the various forms studied is distinctly different in this region. The two species of *Coragyps* however, are similar. This fact appears to substantiate the theory of the generic importance of this structure.

In *Labreagyps* the alinasals form a broad, flat transverse plate extending straight across from the posterior-inferior border of one nostril to that of the other side, with a median partition, or bony septum rising back of the anterior border of the border on the plate and sloping gently posteriorly to the roof of the nasal cavity, where it expands slightly. The other genera differ in the position, shape and size of the median septum, and also in the addition of incomplete lateral septa in some (*Gymnogyps* and *Cathartes*) or even an additional median septum anteriorly (*Gymnogyps*). A more complete discussion of this region in the living genera has been given by Shufeldt (Ost. of Cath. p. 743)

4

Breagyps, new genus

Type.-- Vultur clarki (Miller)

Though the most conspicuous generic characters of Breagyps are to be found in the skull, a review of the type element of V. clarki, the tarsometatarsus, indicates that certain characters of this bone also may be sufficiently marked to be accorded generic significance, particularly in view of the conservative nature of the tarsometatarsus in the Cathartidae. The generic value of other parts of the skeleton will be discussed later in a paper now being prepared, which deals with the hitherto undescribed elements of clarki.

Description.-- Tarsometatarsus: The series of twenty-six tarsi of Vultur clarki, now available in the Los Angeles Museum collections, was examined and compared with the Recent Vultur gryphus of which species but two individuals were available. From these Recent bones the fossil specimens differ 100% in four characters, as follows:

- (1) Outer margin of anterior face of bone thrust backward in the upper third of the shaft.
- (2) Anterior metatarsal furrow narrow with margins swollen and less definitely marked than in V. gryphus, tending to converge slightly near the scar of the ^{anterior} tibialis anticus muscle. Breadth of furrow at level of proximal foramina 6.5 - 8.5 mm. in fossil, over 9 mm. in V. gryphus.
- (3) Outer ridge of hypotarsus inconspicuous. Level with, or slightly receding from outer hypotarsal groove; in a few specimens groove slightly indented, but less so than in V. gryphus.

(4) ~~Metatarsal~~ Just above trochleae, ~~near~~ posterior deflection of metatarsal 2 abrupt, with definite drop backward from median metatarsal.

Other differences hold true in from 84% to 95% of the fossil material but break down in a study of the whole series so have been discarded.

Skull: The complete skull and two separate crania and rostra were compared with both the North and South American Condors as well as the King, Black and Turkey Vultures. Though the attenuated rostrum bears superficial resemblance to Coragyps, the cranium, when viewed from the posterior aspect, shows the occipital region terminating ventrally in the slightly spreading, prominent

~~La Breagyps~~, ~~new genus~~ *Clarki Condor*

Type: Vultur clarki (Miller)

After a careful study of each of the principal elements assignable to Vultur clarki, it has become evident that this species is no closer to the genus Vultur than is Vultur to Gymnogyps or Gymnogyps to Sarcorhamphus. Particularly is this true of the skull, a complete specimen of which (no. K31581) was, for this very reason, originally assigned to Cathartornis gracilis rather than to this species. However, we have since found that C. gracilis is of teratornithid affinities' rather than cathartid, and have reason to believe that the species is not represented at all in the Los Angeles Museum collections from Rancho La Brea. The skull in question is decidedly cathartid in character, and ~~is represented now by the one complete skull, a cranium and two rostra~~ *Three additional specimens, a cranium & 2 rostra have been found* in the collections at the latter museum. Furthermore, these specimens represent the only skulls of large cathartids, ~~the~~ other than Gymnogyps, in the collection. Taking all of these facts into consideration, there seems no doubt but that these specimens of unique skull belong to the species clarki, which is fairly well represented in the Los Angeles coll. by other elements.

In assigning the skull to gracilis, Miller (1925, p. 84) said "The beak ~~is~~ certainly is not that of Sarcorhamphus. It differs from the beaks of the stouter-legged condors in the same way that the beak of Cathartista differs from that of the stouter-legged Cathartes. One is not justified in carrying too far such an analogy of beak and foot, but in the absence of opposed evidence analogy may be added to the limited positive evidence to encourage the step which offers least confusion." And again, (op.cit., p. 85) "The Pleistocene Cathartornis differs more widely from the Recent condors than these two birds differ from each other." Having once ~~proven~~ *decided* to our satisfaction, therefore, that this skull belongs to clarki rather than to gracilis, Dr. Miller and the present writer are in unquestionable agreement that clarki cannot be assigned to the genus Vultur, or to any other genus of living condors, ~~The present writer~~ *and The genus La Breagyps* is therefore proposed to include this species.

Brachyops clarki
SKULL

Cranium B2148; K3404. Beaks J7071, J9069; Complete skull K3158 (mt)

CHARACTERS: 1. Processes formed by lateral angles of temporal area developed to a degree similar to *Gymnogyps* though terminating less knobily; development of processes greater in *Vultur* and less in the other three genera. (2) Occiput high, as in *Gymnogyps*. (3) Lines bounding occiput straight-sided as in *Gymnogyps* and *Vultur*. (4) lacrymal longer antero-posteriorly at its dorsal edge than in any of the other genera, with stout, blunt process extending laterally from its posterior portion; this process slender and pointed in *Vultur* and *Gymnogyps* and curving to extend for some distance posteriorly in the latter; in *Sarcoramphus*, *Coragyps* and *Cathartes* lateral projection scarcely deserving the name of 'process'. (5) rostrum long and slender with elongated narial openings, similar to *Coragyps* in general shape but with more evenly rounded posterior borders of the nares.

(6) well-marked rise in rostrum anterior to nares as in *Vultur* and *Coragyps*. (7) ethmo-turbinal region distinctive and apparently of generic significance: transverse plate broad and flat and extending straight across from the inferior border of one nostril to that of the other side, with median partition rising toward the posterior edge of the plate and sloping gently backward (other forms differing in position and size of transverse plate and position of median partition and in the presence in some of additional lateral partition (*G.* and *Cath.*), and additional median partition (*G.*).

MANDIBLE: Material available: right and left rami possibly of same jaw and one symphysis with portion of right ramus. (1) Two well-defined post-articular processes as in *Gymnogyps* and *Sarcoramphus*, but closer to the former in that the outermost process is noticeably more developed than the inner; inner process distinct in being sharply pointed. (2) inferior border of ramus at articular end straight, not curving downward at outermost post-articular process as in *Gymnogyps* and *Vultur*. (3) Symphysis longer and narrower than in *Gymnogyps* (appears closer to *Coragyps* and *Vultur*). (old no. 1347 2 rami) symphysis no. B1654

Added note: Innermost postarticular process projects almost directly posteriorly. The int. process is well-defined but rounded in *Gymnogyps* and is directed slightly ventrally and posteriorly; it is represented by a long, low rise in the posterior edge of the articular end in *Vultur* and is of varying proportions in the other species, none of which, however, have a well developed postero-external process. The symphysis is longer and narrower than *Gymnogyps*, more closely approximating *Vultur*.

SKULL CHARACTERS (from another sheet of notes).

Cranium (1) surface in internasal region more deeply concave (like *Coragyps* and *Vultur* and *Sarcoramphus* rather than *Cathartes* and *Gymnogyps*). (2) rise of rostrum just anterior to nares marked as in *Vultur* and *Coragyps*. (3) Shape of narial opening closest to *Coragyps* but posterior border evenly rounded. (4) lacrymal shaped more like *Vultur* (?). (5) Orbital septum has vacuities similar to *G.*, *V.* and *Sar.* (6) Lateral angles of basitemporal area forming conspicuous processes as in *G.*, *V.* and *Sar.* (very low in *Coragyps*, less low in *Cathartes*). (7) Posterior wall of orbital cavity resembles *G.* and *V.* in flatness and transverse ridges. (8) Lines bounding occiput similar to *G.* and *V.* (straight-sided), more rounded in *Cor.*, *Cath.* and *Sar.*

a. Process of nasal which articulates with lacrymal bone and with slight additional process ventrally (appears closest to *Vultur*). b. Inferior and posterior margins of bony nostrils blend with transverse plate of ethmo-turbinals and this plate is broad and flat and practically straight

across with median partition rising gradually and considerably back of anterior margin of the plate. Unlike all others though G. is broadest and flattest and partition about same (however G. has additional a partition and turned up anterior margin as well as extra lateral support). Sarcoramphus also is flat but is higher than inferior border of nostril and part is less gradually inclined and further back. In Vultu the plate narrow and sloping up slightly both posteriorly and medianly and not like Breagyps. Apparently this character has but little to do with the shape of the beak itself for Coragyps (which is most like the fossil in general shape of beak) has the plate set well back and it is narrow and not so flat and has extra lateral support, a steep partition arising directly from the anterior edge of the plate (really across the whole plate from anterior to posterior).

The lacrymal in the fossil is broad in extent at its dorsal edge, broader than in any of the other genera and is perforated by a large, well formed foramen, visible both on its external and internal surfaces. In each of the other genera the perforation is evident internally but is lacking externally or if another is present it occurs in the facet for the nasal IG.) or on the surface corresponding to the external in the fossil but which faces slightly anteriorly rather than directly laterally (Coragyps). In Vultur a large depression exists on the external face but does not pierce the bone.

FROM OLD NOTES

(1933)

Breagyps clarki

Tarsometatarsus

26 specimens Breagyps

26 specimens Breagyps

RLB Gymnogyps 385 specimens (174 left complete, 168 right complete, 21 proximal, 22 distal)

Tarsometatarsus of Breagyps clarki differs from that of Gymnogyps in the following points:

In general resembling Vultur gryphus: shaft deeper antero-posteriorly internal condyle broader and deeper. Other differences from Miller:

1. Shaft more nearly cylindrical. 2 less excavated in front. 3. prox. foramina nearer together. 4. inter tibial facet raised farther above outer.
5. intercotylar tubercle larger and more glovular. 6. diameter of shaft contracts more suddenly just below head. 7. excavation of shaft in front less abrupt and less restricted (see 2).
8. narrowest point at or above middle and not below. 9 width of shaft less. 10 foot narrower (NOTE: relative to length probably averages a little less but overlaps and actually is less).
- 11 Trochleae longer and more slender (actually average more slender but relative to distal breadth they are broader and deeper).
12. Tuberosity in side view appears more knob-shaped. 13 Hypotarsus higher, its outer ridge less pronounced. 14. Lateral margin of external facet drops downward and forward more abruptly. 15 Shaft thicker throughout length. 16 outer trochlea less stubby. 17 Greater antero-posterior depth of head. 18. Groove separating hypotarsus from shaft shallower and less perfectly defined. 19 Posterior profile of hypotarsus less deeply indented (varies some and is just as deep)

On the whole the fossil shows greater differences in comparison with Gymnogyps than with Vultur. Gymnogyps and Sar. show similarities, and Vultur and the fossil show similarities. Adding Cathartes and Coragyps, the former should go with Gymnogyps and the latter with Vultur. Actually there is not greater similarity between Vultur and the fossil than between Gym. and Sar..., so the fossil can easily be generically separated from Vultur.

Breagyps clarki

Tibiotarsus

Outer cnemial crest longer and straighter from its proximal extremity to its connection with the shaft than in G (closer to V in this respect though surface at proximal tip of crest narrower, more convex)

(2) anterior portion of internal condyle (seen in lateral view) less deeply excavated and less heavily margined than in G, Sar. or Cath (closer to Coragyps and Vultur though not identical). (3) ligamental attachment above external condyle prominent; a small foramen external thereto (attachment less developed in G and foramen proximal to it; offsil closer to V or Sar. though even in these genera the foramen is more proximally placed).

Outer cnemial crest well marked for greater distance down shaft than in G (opposite or distal to proximal end of fibular ridge), also longer than in Sar; closer to V. The connection of the crest with the shaft is more evident than in G. In the latter this region is well rounded while in the fossil the crest stands out as a short flange which continues into a short ridge (closer to V).

Internal condyle (lat. view) less deeply excavated and less heavily margined anteriorly than any other genus, but closest to V and Cor, but not identical. Distal end curves between condyles symmetrically and is broadly curved. Not symmetrical in G; Vultur and Sar. more nearly so though not quite the same. Cathartes symmetrical but not same. Prominent ligamental attachment proximal to external condyle anteriorly with small nutrient (?) foramen external to it. In Gym. the attachment is flattened and the foramen is proximal to it. Closer to Sar and V. but not identical (foramen is too proximal in V) (attachment not large enough in Sar. Shaft straighter in lateral profile than in Gym. In Gym shaft bows anteriorly and even Vultur and the other do a little. Shaft breadth and depth same as Gym and Vultur.

Breagyps: 5 complete, 1 nearly complete, 4 prox., 10 dist. The two 'Cathartornis' tibiotarsi fall in with Gymnogyps.

Gymnogyps amplus 108 complete, 65 proximal, 166 distal

Mine, Pelvis

Synsacra
length

B 1082

Breagyps

opisthotic processes heaviest (of all cathartids?)
and have their lateroposterior corners drawn out and produced
posteriorly
external, ventral surface of maxillopalatines more deeply excavated
and indented. FROM FISHER, 1944 p. 292

Compared to Gymnogyps, Breagyps has a wider and higher, but shorter
brain case

Wider frontonasal hinge

Somewhat narrower ventral occipital area. FISHER op.cit

Crania of ~~Gymnog~~ Breagyps and Gymnogyps separable only on basis of
development of occipital processes and
Excavation of maxillopalatines (plus size difference) FISHER opcit

Attached:

Old Notes

Breagyps

See later study in separate folder
1970's
for completed paper

1909 West Imperial Highway
Los Angeles, California 90047
Phone / 754-3998

•
Parsonage / 1918 W. 112th St.
Los Angeles, Calif. 90047

•
William F. Reynolds
Minister of Music

+

IMPERIAL HEIGHTS COMMUNITY CHURCH OF THE BRETHREN

B. Wayne Crist / *Pastor*



Breagyps clarki study from old notes (of 1933)

STERNUM

Seven

Material available: ~~Eight~~ specimens, all chipped and worn and lacking posterior border; carina nearly complete in three: B1428 (photo) ^{and} B4554, B 5669, B3783, B3372, B1517 and B3071 (an eighth (B1403) is probably Gymnogyps.

^{Description:} Characters: 1. Apex of carina approximately in a line with ^{posteriormost} last costal process, sloping upward from this point, both anteriorly and posteriorly, though at a greater angle posteriorly; in none of the modern genera is the apex so far anterior, except in Cathartes, where the carina has a continued upward slope from the anteriormost tip; also in none is the anterior slope so well marked; Vultur and Coragyps are closest. 2. Length of costal margin relative to breadth of sternum less than in Gymnogyps, equal to Vultur. 3. Articular facet of ventral lip of coracoidal sulcus broadening at lateral extremities by flaring dorsally; resembling Vultur, but unlike Gymnogyps, Coragyps or Sarcoram.

SCAPULA

Material available: six right, seven left: B4450 (photo), B4862, ^RB1657, ^RB1676, ^RB3420, ^RB1670; ^LB6020, ^LB2259, ^LB1671, ^LB6332, ^LB3482, ~~B7558~~ ^RB7558, ^LB4418.

Characters: The chief distinguishing characters of this element lie in the acromial region: acromion rises from shaft more acutely and abruptly (others more broadly and gradually round into shaft); acromion doesn't form as marked or pointed a tubercle on ventral side as Gymno., or Vultur (nearer Sarcoramphus); acromion ends higher on shaft than other

1909 West Imperial Highway
Los Angeles, California 90047
Phone / 754-3998

•
Parsonage / 1918 W. 112th St.
Los Angeles, Calif. 90047

•
William F. Reynolds
Minister of Music

+

IMPERIAL HEIGHTS COMMUNITY CHURCH OF THE BRETHREN

B. Wayne Crist / *Pastor*

VALLEY FORGE LAMP

RAG CONTENT

U.S.A.



Breagyps from old notes on Vultur Clarki (of 1933)

CARPOMETACARPUS

Material available: Eight right, seven left: J9402 right (photo),
B6712, B3625, B2168, B2667, B5331, B1755, B2632, B2181, B7608, B4160,
B1075, B6395, B4375, B3154.

Characters: Metacarpal I less prominent than in Gymnogyps or Vultur;
and does not extend as low on shaft (height of M I relative to length
less; proximal metacarpal symphysis as in Vultur (shorter than in
Gymnogyps); tuberosity of metacarpal 2 does not extend so far up
shaft as in Gymnogyps or Vultur and connects with shaft at more abrupt
angle than Gymnogyps (angle about same as Vultur); M 1 directed
upwards slightly; depth of proximal end relative to length averages
22.0%; other genera run from 23.2 to 25.8 %.

FEMUR

Material available: Complete (or nearly so) five right, nine left,
six distal, 2 proximal, 1 shaft with part of distal end: Complete
B5580 (photo), B1404, B7493, B6259, B3379, B5693, B3358, B5873, B3576,
B6910, B7803, B4989, B2599; distal B6620, B3388, B1574, B1437, B7460,
B5950; proximal B2257, B6372; shaft B6938

Characters: 1 Ligamental attachment above ext. condyle (viewed ant.
or lat) more distinct (slightly raised) than in G. neerer other genera
(g. flatter than all others; 2 Trochanteric region with more noticeable
forward flexure than other genera; 3 Attachment of round ligament narrow
cutting ant-postly and deeply tunneled ~~xxxxxx~~ head of femur (nearest Vultur);
4 fibular condyle shorter anterioposterly than Gymnogyps (similar to Vul)
5 greater flexure in inner part of shaft at proximal end (ant. view)
6 ends relatively broader than either G. or V and dist. end relatively
broader than deep than in these two; 7

1909 West Imperial Highway
Los Angeles, California 90047
Phone / 754-3998

•
Parsonage / 1918 W. 112th St.
Los Angeles, Calif. 90047

•
William F. Reynolds
Minister of Music

IMPERIAL HEIGHTS COMMUNITY CHURCH OF THE BRETHREN

B. Wayne Crist / Pastor

1451
1411
1451
1428
length car/w. 134m

redwood car/w. 81635



Vultur clarki

#s B1499, B4320, B7699, B7124, B8039, B3424,
B6188, B2311, B7847, B8376, B7495, B7067
Coracoid B7914, B7743, B2644, B7479, B1638
B3821, B3242, B1739 (photo)

check list 9/11
#3837
in mt

Material available.-- Eleven right, nine left coracoids.

Characters.-- 1, ~~External~~ Furcular facet tending to be obliquely depressed from posterodorsal to antero-ventral margins (somewhat similar in this to Coragyps and to some individuals of Gymnogyps though in the latter the depression is less obliquely situated); 2, border of furcular facet, on internal side of bone, slightly concave, the curvature occurring near the dorsal edge (closer to Coragyps in this character); 3, ~~ventral~~ ^{internal surface} edge of bone immediately posterior to furcular facet sharply curved, almost angular in contour (unlike Gymnogyps, Vultur or Sarcorhamphus and closer to Coragyps, though in this genus the edge is even more angular, due to the marked depression of the internal face of the bone adjacent to this edge). Though in the above characters the fossil appears to resemble Coragyps, the general shape of the head regio as seen in external view, is distinctly different, being broadly rounded rather than pointed, and having a more prominently developed bicipital attachment.

4, Procoracoid in clarki projects more posteriorly (dorsally) than in Gymnogyps. 5, Relative height of procoracoid near Gymnogyps.

Sternocoracoidal impression deeply excavated, cutting back above sternal facet toward outer edge.

Vultur clarki

Humerus

Material available.-- Two left, two right, nearly complete, five distal end and seven proximal end.

Characters.-- 1, ^{gynoid} Tuberosity at distal end of deltoid crest nearer edge of shaft than in Gymnogyps (nearer to Vultur or Sarcoramphus);
2, distinct pneumatic opening in area between external condyle and ect-epicondylar prominence; 3, on palmar side, ^{pictorial attachment} ~~muscle area of deltoid crest~~ long and narrow and bounded by evenly curved line (closest to Vultur, ^{irregularity of line} though area of greater extent proximally; in Gymnogyps and other genera area broader ~~distally~~, narrowing abruptly ~~toward~~ proximally).

Complete: B3246 ^{mt}, B7730 ^{comp L}, B8002 ^{complete}, B7731 + B7739 ^{2 pieces bone R. prox}
Distal: B7247 ^{short}, B4368 ^{short}, B4847 (photo), B2034, B5914, B5956
Prox: B5329 (photo), B3356 ^{where?}, B1583 ^{R.}, B5917 ^{L.}, B4954 ^{R.}, B2083 ^{L.}, B2156 ^{L.}

- 4 Curvature of shaft as in Gymnogyps, Vultur straight
5 Region between external condyle & ectepicondylar prominence deeply excavated & perforated; somewhat similar condition in Calnautes & Coragyps but not in Gym. Vul. or Sarcoram.

B6318 L prox

Viewed dorsally the proximal contour from coracoid facet to acromion is straight, lacking marked anterior protuberance
SCAPULA Scapula

Material available: Six right ~~and seven~~ ^{thirteen} ~~left~~ ^{Nos.} B 4862 (in mounted specimen), ~~B4450~~, B1657, B1676, B3420, B1670~~4~~ and seven left ^{Nos.} B7558 (in mounted specimen), B2259, B6029, B1671, B6332, B3482, B4418~~4~~.

Description: The chief distinguishing characters of this element lie in the acromial region. ^{Viewed from ventral side} Acromion arising from shaft abruptly and at an acute angle; ^{markedly deflected dorsally, resulting in a depressed dorsal contour.} and lacking marked tubercle on ventral side. ^{rounds into shaft more broadly and gradually}

Comparisons: Acromion ~~next to the coracoid~~ ^{more or less} ~~gradually~~ ^{gradually} ~~and~~ ^{and} ~~broadly~~ ^{broadly} in other genera of cathartids, and ends lower on the shaft. ~~xxxx~~

A marked tubercle appears on the ventral side of the acromion in Gymnogyps and Vultur. Breagyps more nearly resembles Sarcoramphus

papa. ^{Depressed contour in fossil results from greater dorsal deflection of acromion.}
CORACOID

Material available: Twenty specimens, Nos. B1495 and H3837 (in mounted specimen), B1^R499, B6^R320, B7^R699, B7^R124, B8^R039, B3^R424, B6^R188, B2^R311, B7^R847, B8^R376, B7^L067, B7^L914, B7^L743, B2^L644, B7^L479, B1^L638, B3^L821, B3^L242, B1^R739. ^{upper end F1879}

Description: ① Furcular facet ~~tending to be obliquely~~ ^{markedly anterior} ~~depressed from postero-dorsal to antero-ventral margins;~~ ^{and projecting prominently anteriorly resulting in a curved contour of head} ~~border~~ of furcular facet on internal side, slightly concave, the curvature occurring near dorsal edge; ^{② anterior} ~~ventral~~ ^{edge of bone immediately posterior to furcular facet sharply curved, almost angular in contour; head broadly rounded and having prominently developed bicipital attachment; procoracoid projecting relatively high and projecting posteriorly (dorsally); sternocoracoidal impression deeply excavated, cutting back above sternal facet toward outer edge.}

Comparisons: Breagyps is closest to Coragyps in characters 1-3 above, ~~xxxx~~ but the shape of the head is distinctly different being broadly rounded rather than pointed and having a more prominent y developed bicipital attachment. The ^{relative} height of the procoracoid is close to that of Gymnogyps but ~~xxxx~~ it projects more posteriorly than in that modern genus.

Lower Mandible

2

Material available: Right and left rami, possibly of the same jaw (old no. 1347*) ~~now in mounted specimen~~; symphysis with portion of right ramus (B1654), and ~~1 articular end (left)~~ B7374

Description: ~~Two well defined post-articular processes as in Gymnogyps californianus and Sarcoramphus papa, but more closely resembling Gymnogyps in that the outermost process is noticeably more developed than the inner~~

~~Articular end with~~
Two well defined post-articular processes ~~with~~ ^{the} outermost process noticeably more developed than the inner; inner process sharply and projecting directly posteriorly pointed. Inferior border of ramus at articular end straight; symphysis long and narrow.

Comparisons: The ^{external} post-articular process ~~is~~ ~~xxx~~ well-defined in both Gymnogyps and Vultur; ~~the~~ ^{xxxx} internal process is well-defined in Gymnogyps but is rounded, not pointed and ^{is} directed slightly ventrally as well as posteriorly; in Vultur the internal process is represented by a long low rise in the posterior edge of the articular end. The proportions of the symphysis most closely approach ^{the condition in} Coragyps or Vultur.

check this again 7.11.72
omit

NOT

Post cranial
Resembles Gymnogyps in that the articular end has two well-defined post-articular processes with outer process noticeably more developed than the inner; distinguished from Gymnogyps however in that

At articular end the innermost of the two post-articular processes is sharply pointed and projects directly posteriorly, whereas in Gymnogyps this process is rounded & directed slightly ventrally as well as posteriorly. In Vultur this process is poorly developed & is represented only by a long low rise in the posterior edge of the articular end.

The symphysis resembles Vultur more closely than Gymnogyps being longer & narrower than in Gymnogyps

LIST OF SPECIMENS NOW ASSIGNED TO BREAGYPS CLARKI

*Enter in catalog
when Howard paper
published*

7-1 STERNUM: B1428 (in mt; illus Howard), B1517, B3071, B3372, B3783,
B4554, B5669

7-2 FURCULA: B2224, B2601, B6035, B8114, B8415, and B8308 and B8309
(which are in the mt)

13-2 SCAPULA: B1657, B1670, B1671, B1676, B2259, B3420, B3482, B4418,
B4450 (illus), B4862 (in mt), B6020, B6332, B7558 (in mt)

14-1 HUMERUS: B1583, B2034, B 2083, B2156, B3246 (in mt), B4847 (illus)*
B4954, B5329 (illus), B5917, B5956, B7730, B7737+B7739
(proximal and distal ends of same bone), B7247, B8002

*and?
in mt*

*
18-4 ULNA: B1859, B1910, B3553, B3838, B4221, B4630, B5891, B6914, B6912,
B6925, B7248, B7503, B7715, B8310. In mt K3353 and B4458 (proximal)
and B592 and B1665.

16-2 CARPOMETACARPUS: B1075, B1755, B2168, B2181 (in mt), B2632, B2667
(in mt), B3154, B3625, B4160, B4375, B5331, B6395, B6712,
B7608, B3271, J9402 (illus),

8-2 PELVIS: B4912 and B5165 (in mt); B1082 + B1092 (parts of same bone),
B1635, B3346, B6859, B6865, B7895.

21-2 FEMUR: B1404, B1437, B1574, B2257, B3358, B3379 (in mt), B3388,
B3576 (in mt), B4989, B5580 (illus), B5950, B5693, B5873,
B5693, B6259, B6910, B6372, B6620, B6938, B7493, B7803
B2599, B7460, *not included*

19
21-2 TIBIOTARSUS: B7026 and B7746 in mt; B5878 (illus), B4039, B6404,
check #s B6414+ B6413 (distal and proximal of same bone), B3361,
*2 distal
whichever* B2314, B2115, B7085, B6477, B5156, B1074, B7244, B1593,
B2116, B3383, B8313, J9629, B7951, B7977?

21-2 CORACOID: B1495 (in mt), H3837 (in mt); B1499, B1638, B1739 (illus),
B2311, B2644, B3242, B3424, B3821, B6320, B7067, B7124,
B7479, B7699, B7743, B7847, B7914, B8039, B8376, B6188

2 RADIUS: B6782, B7661

4 Vertebrae

1560



Characters similar to Breagyps:

- Depth of ilio-ischiatic surface of pelvis -- Coragyps
+swollen area above
Deep brachial impression of ulna -- Sarcoramphus, Coragyps
Broad, straight anterior contour of sternum -- Vultur and Coragyps
Lateral position of distal tip of pectoral -- Vultur, Coragyps, Sar
Bicipital crest of humerus rounded -- Vultur, Sarcoramphus
Internal border of trios canal coracoid triangular -- Vultur, Coragyps
Contour and size of foramina in pelvic shield -- Sarcoramphus
Degree of flare of acromion of scapula -- Sarcoramphus?
Depression and margining of deltoid of humerus -- Cathartes
Angle of intermuscular line of femur -- Cathartes ?
Deep fossa below brach. tub. of coracoid -- Vultur, Coragyps
Iliac crest overhangs acetabulum -- Gymnogyps, Coragyps
Degree of pneumaticity of dist. humerus -- Gymnogyps
Development of ectepicondylar process -- Gymnogyps?

Similar

Pelvis

Anterior ilia meet in midline
(but less narrow or long ridge
shield moderately convex in midline)

fewer perforations in
shield and smaller
iliac crest slopes down
iliac crest recedes above
acetabulum

Carpometacarpus

depression anteriorly
adjacent to tuberosity
of M2 (distal) (but
tuberosity not as prom.)

distal symphysis very
long and flat
less depression in
prox. symphysis
trochlear ~~rest~~ evenly
rounded distally
tuberosity of M2 longer
and less prominent.

M1 process shorter and
more forward im position

Ulna

brachial impression less
depressed and no swollen
area above it

distal ext. condyle
narrowed

Coracoid

border trios. canal angular

deep fossa below brach
tub. (deeper than Brea)
head evenly rounded

Scapula

Acromion joining shaft abrupt.

acromion less flared
and less deflected med.
Very prominent antero-
ventral projection
Space between acromion
and glenoid narrower and
less depressed

Sternum

Shape of carina, depth and apex
dorsal lip of sulcus squared laterally in anterior contour

Apex (however) more post.
~~Square~~ ~~with~~ ~~line~~ ~~anteriorly~~
~~(border~~ ~~of~~ ~~dorsal~~ ~~lip~~ ~~of~~ ~~snout)~~
dorsal depression less

Furcula

Broad, gradual curvature of
prox. part clavicles
pneumatic fossa stops short
of ventral border of clay.

dorsal rim less under-
cut by pneumatic fossa
area anterior to scap atip
(externally) not expanded

Humerus

xxxxxxpectoralxxxxxxedge
 xxxxxthisx pectoral attach
 broadens gradually and tip
 at edge of shaft

very faint depression below head narrower, more curved and
bicipital crest rounded (but less prominent laterally) more laterally projected

Similar

Different

Femur

contour of proximal end,
anteriorly from trochanter
to head smoothly curved
bone flares proximally then
narrows to shaft

attachment of round lig.
shallower and broader
Shaft straighter in lat.
~~contour~~ profile
trochanteric crest not
bordered by foramina
less deflected med. troch.
Ligament attach above
fib. condyle ~~larger~~ small
and facing posteriorly

Tibiotarsus

External cnemial crest long
extending to level of
prox tip of fib. crest
and below level of int. cnem
crest.

External condyle blunt with prox. ~~border~~
set off from shaft, inclined
externally

Ext. condyle
shorter prox-dist.

XX

Similar	Similar	Different
Pelvis	pelvic shield	receding posterior ilia anterior ilia apart
Carpometacarpus	both symphyses short	less prominent tubers of metacarpals 2 and 3 gradual conn. troch. crest; narrower M1
Ulna proximal	deep brachial impress. and area above swollen	olecranon more ptd an more set off from cotyla in intern. contour
Ulna distal		external condyle narr narrower and more separated from shaft
Coracoid		Head more evenly dev no diagonal groove shallow or no fossa below brachial tub. rounded edge of trios
Sternum		Anterior contour nar- rower and gradually curved carina not so deep and apex more posteri
Scapula	✓ Degree of flare of acromion and broad depression bet. acrom and glenoid facet	function of acromion with shaft less acute glenoid facet narrow
Furcula		narrower arch of clavicles
Humerus	✓ pectoral crest ends near edge of shaft bicipital crest rounded contour	edge deltoid crest not heavily bordered pectoral crest broad abruptly. lacks pneumatic foramina distally deeper pneumatic impression below head

Similar

Different

Femur

attachment of round lig.
round, shallow (not
narrow, deep)
trochanteric crest has
more abrupt mediad curve
proximal to foramen only

Tibiotarsus

external crest shorter
than int. crest
Int. cnemial crest less
prominent and meeting
shaft more gradually
external condyle not
projecting laterally
at prox. tip

Coragys vs Breagyps

	Similar	Different
Pelvis	iliac crest overhangs acetabulum ✓ ilio-ischiatic area nearly as deep	iliac crest overhangs acetabulum shiled flatter, foramina more numerous anterior ilia separated
Carpometacarpus	abrupt junction of trochlear crest with shaft ✓	tuberosities of M2 and M3 less developed more pneumatic in trochlear area proximal symphysis longer
Ulna	deep brachial impress. and area above swollen	distal ext. condyle narrowing proximally olecranon less blunt and less set off from cotyla in int. contour
Coracoid	✓ projection of brachial tuberosity and size of fossa beneath angular trios border	head more evenly proportioned narrower furcular facet more deeply depressed trios <i>camel</i> coracoidal fenestra very close to edge of procoracoid and poorly developed neck less depressed
Sternum	anterior contour	dorsal depression less apex of carina more post
Scapula		Less abrupt junction of acromion to shaft; more flared laterally (acrom) area between acrom and Glenoid even more depressed than <i>Breagyps</i> Ventre-anterior projection even less than Breagyps greater mediad deflection of acromion even than Brea.
Furcula		arch of clavicles very acute
Humerus	Pectoral crest near edge Distal pneumatic depressions <i>but even more than Breagyps</i>	Bicipital crest square contour deltoid not heavily rimmed pectoral broadens abruptly great impression below head more curved shaft <i>Ext. condyle, prom. more tapered post by</i>

Gymnogyps vs. Breagyps

Similar

Different

Pelvis	iliac crests (post) xx overhang acetabulum	ant. ilia more widely sep. centr of shield more convex post contour iliac crest slopes downward
Carpometacarpus	dist. symphysis short	prox. symph. longer & less depressed trochlear crest evenly round tuberosities of M3 (prox) and M2 (dist.) more ridgelike and less prominent
Ulna	olecranon blunt and interruption set off from cotyla (in int. contour)	less depression of brach.im. and blends gradually into cotyla Dist. ext. condyle narrowing proximally and set off from shaft
Coracoid		rounded internal border trios. fossa below brachial tub. less developed evenly rounded furcular facet and head
Scapula		acromion arises gradually & is less medially deflected coracoidal articulation more balllike and anteroventral projection more marked space between acromion and glenoid narrow and less depres
Sternum		anterior contour narrower and more grad. curved carina lower and apex more post.
Furcula	broad gradual dorsal curvature Deep pneumatic fossa under cutting dorsal rim ventral expansion anterior ventral expansion anterior	pneumatic fossa which under cuts dorsal rim is here ventrally extended ventral expansion ant. to scapular tip not shelf and foramina small, dorsal area broader
Humerus	distal pneumaticity?	bicipital crest uneven and less broad no heavy rim on deltoid pectoral attach broadens abruptly, ends mediad deep depression below head

Gymnogyps vs Breagyps

Similar

Different

Femur

more columnar shaft
less anterior flexure of trochanter crest
shallower, more rounded attachment of round lig.
bulge mediad of trochanter (on ant. surface)
lig. attach above fib.
condyle small & deep and facing posteriorly

Tibiotarsus

external cnemial crest short
ligamental attach. above ext. condyle less dev. & foramen more prox.

Breasts compared to Sacraunflus

head overhanging ^{thence} capital groove + groove deeply depressed

Sac. " NOT " " " " " NOT " "

Brea. Deltoid crest (anteriorly) heavily rounded especially in dorsal half

Sac. " " " " NOT " "

Brea. " " " " moderately depressed medially of vein

Sac. " " " " NOT " "

Brea. Pectoral attachment broadening gradually from a point prox ^{distant} to breast

Sac. " " " " abruptly below " " " " " "

Brea. Very slight depression below head on palmar side

Sac. well marked pneumatic depression below head on palmar side

[Brea + Sac. Broadly, evenly rounded contour of bice pital crest
② Pectoral attachment ending distally, near lateral margin of shaft]

Brea. (Distally) attachment ant. ligament moderately indented by pneumatic

Sac. " " " " deeply " " " "

Brea. Marked pneumatically indented by ext. cond. + base of ep. prom.

Sac. NO " " " " " "

Sternum

Brea. Deep carina with apex at level of last costal process

Sac. Moderate " " " " well prominent " " " "

Pelvis

Brea. Anterior ilia meeting in midline - forming sharp deep angle

Sac. " " " " separated " " " " + angle broad + shallow

Brea. Dorsal contour of post. ilia + ventral contour of ischia nearly parallel

Sac. " " " " " " " " tapering posteriorly

Brea. Iliac crest protruding above antitrochanteric area between depressions

Sac. " " " " NOT " " " " " "

Brea. deep notch on inside of acetabulum anterior

Sac. faint (faint) " " " " " " " "

[Brea + Sac. ant. ilia regard ant edge of sacral notch lines
in one Sac. only. (Brea not marked) both Brea]

Saurorhynchus vs. Brachypterus
Coarctus

- Brea Head ~~more~~ prominent portering with diag. ^{on foveolate facet} groove ¹ visible in int. foveolae
- Sar Head not so " " " " NO " "
- Brea Deep fossa below anterior projection of fove. facet, rimmed int. by acute edge of this ^{can.}
- Sar. Shallow or no fossa " " " " " " edge rounded not acute
- Brea Distal contour of foveolar facet slightly concave towards post. side
- Sar " " " " " " straight all the way across
- [Brea + Sar foveolar facet. on change. ^{depressed} foveolar canal (but depression more)
Palmaris confined in Brea, 1
- Brea Attachment of coracobrachialis muscle a from distinct raised tubercle on shaft of bone sterno coracoid impression
- Sar Attachment less distinctly marked + blending with upper lateral border of the sterno corac. impression
- Brea Neck depressed, ^{ligament attached above} ~~corac. process of scapula~~ prom. (short + deep)
- Sar " NOT " " less " "

Scapula

- One Sar (765) ^{nearly} resembles Brachypterus in ^{almost as} abrupt ² position of acromion with shaft, the other is more gradual but medial bend is more marked in Brachypterus.
- ~~foveolar articulation is not as~~ ^{prox. advanced in Brea}
- Glenoid facet is ~~broad~~ relatively shorter + broader in Brea

Carpometacarpus

- Brea Dist. crest of phalanx forms abrupt connection with shaft
- Sar " " " " " " gradual curve into shaft
- Brea Tubercle on M3 (prox) a distinct prom. tubercle
- Sar " " " " " " more ridge like + less projection
- Brea Process of M1 heavy
- Sar " " " " " " narrower + more projected ^{dist.} ¹ ^{ant.}
- [Brea + Sar both have short prox + dist. symphysis + post. contact M3 gradual ^{can.}
- Brea Tubercle (dist) M2 short but prom. heavily rimmed ant. depression dist. + int.
- Sar " " " " " " M2 longer + less " " " " NO " "
- ~~scapula + Sar same proportions~~

Phaenops compared to Sauroamphius

Genus

- Pha Area 'interior' to obturator ridg. & below iliac ^{head markedly depressed}
- Sau " " " " " " " " " " NOT " " "
- Pha Attach of rd. lig on head a deep, narrow slit
- Sau " " " " " " " " " " a round moderate deep pit.
- Pha Shaft below head ^{forms broad rapid} ~~curve~~ ^{emphasis in projection} head
- Sau Shaft ~~obtain~~ broader ^{more gradually} ^{but gradual} ^{protrusion} ^{flange}
- Pha Troch. ridg. has decided medial ^{curvature}
- Sau " " " " has more abrupt medial ^{curvature} above ^{pronation}

Ulna

- Pha Brachial impression broad, moderately depressed
- Sau " " " " narrow, deeply " "
- Pha & Sau impression is set off from int cotyl. by protrusion of bone & depression of impression, but the ^{depression} is more marked in Sauro.
- Olecranon broader in Phaenops.
- Pha Prox radial depression deep & underneath ext. cotyla
- Sau " " " " shallower + NOT " " "
- Pha Distally external condyle broad & closely appressed to shaft
- Sau " " " " narrow & set off from shaft by undercut & ^{pneumatic}

Tibia

- Pha Ext Omerial crest longer than inner omerial crest ^{Protrusion}
- Sau " " " " shorter " " " " "
- Pha Distinct ridge running distally below ext crest to level of fibula crest
- Sau No " " " " " " " " " " " "
- Pha Int. omerial crest prominent, rugose & meeting shaft abruptly
- Sau " " " " less " less depressed " " " " gradually.
- Pha Ext condyle ^{capitulum} ^{projecting laterally at prox tip.}
- Sau " " " " ^{in line with shaft}

Corapys or Brevipys
Ulna

- Cor. Prox end of brach. impression more pneumatic
- Cor. like Brea in impression being set off from cotylo. by rise
- Cor. distal ext condyle very slender at its prox tip, very pneumatic ~~along~~ medial edge
- Cor. prox pneumatic foramen. bet. ext. cotylo. & olecranon on ext. surface

Humerus

- Cor. More squared distal contour of brach. crest & shaft more pneumatic below head palmar.
- Cor. No heavy rim of deltoid crest anteriorly nor adjacent depression
- Cor. head overhangs capital groove like Brea. but groove is ~~even more~~ depressed & very pneumatic
- Cor. ^{head on} Int. tubercle depressed giving effect of prox. ext. projection at outer tip.
- Cor. more curved shaft
- Cor. Pect. attachment broadens abruptly below level of brach. crest Brea. is more gradual. But resembles Brea in tip of pectoral at ext. edge of shaft.
- Cor. Distally very pneumatic even in brachial depression. Also undercutting of attachment. lig. more pneumatic than Brea but depression around int condyle less ^{pneumatic} ~~pendant~~ than Brea
- Cor. Eclypeous prom. more tapering proximally than Brea.

Ichthyosaurus

- Cor. Ext. enamel crest sharper than Brea (about equal to int in depth) No ridge below for. to level of fib. cond. however.
- Cor. Ext & dist cond. incline with shaft

Sauroauifilms distinct from Brachyops
Sternum ① carina apex post. to last costal
furcula

Scapula ① glenoid facet narrower & longer
? ② acromion more forward project

Coracoid ① head less prom. & no diag. groove
② edge of tris. canal rounded - fossa small
③ straight edge fac. part
④ less distinct attach for coracoacromial (dist)
⑤ neck not depressed

Humerus ① deltoid not heavily mus. or depressed
② abrupt post. attach
③ deep depression below head
④ ext. cond. not indented

Ulna ① brach. int. narrow & deep
② shallow radial depression
③ ext. cond. narrow & set off from shaft

Carpus ① Trough crest gradual & short
③ Tub. M3 ridge not tab.
④ narrow pr. M1
⑤ dist. - tab M2 long not heavily mus.

Pelvis ① ant. ilia not united
② iliac crest not protruding
③ No notch in acetab.

Femur ① No depression adj. obturator ridge
② Rd. lig. attach. low & mod. deep
③ shaft broadens rimmed below head
④ Trough crest abrupt - mediodorsal, not smooth curve

Tibia ① short ext. creasil dist. to no ridge below
② int. creasil crest meets shaft gradually
③ Ext. condyle in line with shaft

Craggys distinct from Brachyops

Sternum

Manubria

- Scapula ① more prom. laterally, flares acromion
no areola abruptly
② Ant. ventral protrusion even less than Brachyops

- Coracoid ① narrow furcula facet
② less prominent head - no dig groove
③ Neck less depressed + lig attach. less prom.
④ X-ray below procoracoid poorly dev

- Humerus ① Square contour bicipital crest
② greater pneumatic below head
③ No head min of keltad
④ Caputae groove very depressed + pneumatic
⑤ Groove in int. tub.
⑥ more curved shaft
⑦ abrupt contour pectoral attach.,
8 more pneumatic distal

- Ulna - ① more pneumatic, brach. impress.
② ext condyle slender + purt. + pneumatic below

- Carpus ① slender pro. M1 more ant.
② ridge like tub M3 prox
③ dist contour M3 more angular + higher
④ Tub M2 longer + less prom.
⑤ more pneumatic dist epiph

Femur

- Tibia ① ext condyle crest slender - no ridge
② ext cond in line with shaft

~~Greater distal~~ ~~from~~ Pelvic distortions from Pterygia

Scapula ① acromion not deflected medially
② marked antero-ventral protuberance

Cervicoid ① Head ~~has~~ evenly rounded contour lacking
diagonal depression

② Greater ant proj of back-fab. w the deeper
fossa below

Humeri ① No pneumatic fossae ~~underneath~~
adjacent to dist condyles

Ulna ① ~~Scapital~~ ^{basal} impression only moderately depressed
+ blends gradually to ext cotyla

② Narrower external condyle.

Carpus ① less depressed prox symphysis + process of
process of M1 with carpal area

② ~~longer less from sub q d d~~
^{of Glenoid} High distal symphysis

Pelvis ① shield less perforated

② No deep notch in acetabulum

Femur ① shaft straighter

② ~~Archambeu~~ crest not bordered by pneumatic

③ Attachment 2nd lig. larger.

④ Intermuscular line not abruptly deviated

Fibrotas ① shorter external condyle (broad ant)

The general shape of the scapula is similar to that found in Gymnogyps and Sarcoramphus but the acromion proceeds from the shaft ^{and there is a more prominent protrusion ventrally} ~~more~~ abruptly ^{in the scapula} ~~and~~ ^{is} ~~more~~ deflected, These distinctions are more marked in contrast to Vultur in which there is even less deflection of the acromion and a much more prominent tubercle protruding proximally on the ventral side. The acromion projects laterally in Coragyps and is also shorter than in Bregyps.

Similarities to Brachyops in Ceratops

Aug 1, 1952

Caromela. — No in all claws.

Coracoid — ^{like Ceratops} border of furcular facet above tub. surface but more arching
angular contour of int. edge of shaft
BUT shape of head pointed in Ceratops (round in Brachyops)

Isium — nothing similar

Tibiotarsus — " " except ext. condyle protrusion but
not exact here

Skull — Ceratops ~~is~~ like Vultur approaches Brachyops in
carina shape but ascent further posterior
(also as in Vultur)

Humeral — CHECK THIS

Scapula — very different in Ceratops

Coracoid of Ceratops

greater depression below furcular facet
narrower

foamium below procoracoid closer to edge than all other Callitardes

Pelvis ant. border of ilium well formed in Ceratops (much like
Brachyops than is Gorniatops) iliac fossa process not
pneumatic C + B + sinuata
Dorsally unlike Brachyops in wide flat area, large deep

Ulna — ^{Ceratops} ext. trochlea narrower than Brachyops + more
pneumatic around it.

depression of bicip. impression as in Brachyops but more
pneumatic.

MANDIBLE: post-articular processes with outer one largest =GYMNOGYPS
straight inferior border of ramus DIFFERS FROM ALL; symphysis
long and narrow, close to CORAGYPS or VULTUR

FEMUR: attachment of round lig. on head close to VULTUR
fibular condyle shorter than Gymnogyps, similar to VULTUR

TIBIOTARSUS: Outer cnemial crest long and straighter than Gym. close
to VULTUR. Less heavily margined and shallower lateral
surface of internal condyle than in all except CORAGYPS
and VULTUR

PELVIS Anterior border of ilium closer to ant. end of synsac. than Gym,
nearer VULTUR; pneumaticity of transverse processes of
synsacral thoracics closer to CORAGYPS; obturator foramen
longer than Gym, closer to VULTUR

Short
CARPOMETACARPUS: ~~Long~~ proximal metacarpal symphysis as in VULTUR
but distal symphysis of Vultur much longer
Angle of connection of tuberosity of metacarpal 2 (dist.)

about as in VULTUR; Mi less prominent than either condor.

HUMERUS Tuberosity at distal end of deltoid nearer ext. edge of
shaft than Gym or Cath; between VULTUR and SARCORAMPHUS.
Muscle attachment along palmar surface of deltoid long, narrow
and evenly curved; near VULTUR in even curving BUT lines
are of greater prox. exten; curvature of shaft similar
to GYMNOGYPS, vultur straighter; region between ext. condyle and
ectepicondylar prominence excavated deeply and perforated,
somewhat similar condition in CATHARTES and CORAGYPS, but not
Gym Vult or Sarco.

CORACOID Depression of furcular facet somewhat similar in CORAGYPS and
GYMNOGYPS, ventral edge of bone sharply curved close to CORAGYPS
though Coragyps even more angular. Also differs from Coragyps
in shape of head

SCAPULA Acromial region broadly rounded and low as in GYMNOGYPS but
with less prominent tubercle at ventral extremity, in this
resembles SARCORAMPHUS more closely. DIFFERS FROM ALL in
apert, acute rise of acromion from shaft

STERNUM Slope of carina DIFFER FROM ALL, but closer to VULTUR & CORAGYPS;
Length of costal margin to breadth less than Gym, equals VULTUR

Vultur 12
Gymnogyps 2
Coragyps 6
Sarcorhamphus 2
Cathartes 1

SUMMARY of COMPARISONS

Mandible Gymnogyps 1, Sarcoramphus 1, Coragyps 1 Vultur 1
 Sternum Vultur2 Coragyps1 unlike all;
 Coracoidunlike 22 1 others1? Coragyps 1, Gymnogyps 1
 Scapula Sarcoramphus 1, unlike all 1
 Humerus Vultur and Sarcoramphus (bet.)1 Vultur1, Cathartes and
 Coragyps 1, Gymnogyps 1
 Carpometacarpus unlike all 2, Vultur 1
 Femur Vultur1, unlike all 2
 Tibiotarsus Vultur1 Coragyps and Vultur1 unlike all 1
 pelvis Vultur2 Coragyps1 Sarcoramphus1

Although certain details of individual elements may resemble one or another of the modern genera of cathartids, the overall picture of Breagyps ~~ixx~~ indicates that it differs from each of these genera in about the same degree that they ~~are distinct~~ differ from each other.

In size, of course, Breagyps clarki has the unmistakable dimensions of a ~~true~~ condor, ~~xxxxxxxxxxxxxxxxxxxxxxxxxxxx~~ As previously noted (Fisher, 1944, Howard and Miller 19) the skull with its long rostrum has a strong superficial resemblance to that of Coragyps. Certain characters, also of the coracoid, are closest to Coragyps. Resemblance to Vultur is found

In size, of course, Breagyps clarki is a condor, characters of the ~~xxxxxx~~ tarsometatarsus

Breagyps clarki has the dimensions of a condor

STERNUM

Feb 11, 1973

Material available: seven incomplete specimens, LACM nos. B1428* (illus.), B1517, B3071, B3372, B3783, B4554, B5669.

Description: Carina deep and nearly straight, posteriorly ascending abruptly at level of last costal process.

Comparisons: In *Gymnogyps* the ventral margin of the carina is gently convex and the

Comparisons; In both *Gymnogyps* and *Vultur* the posterior ascent is less abrupt and ~~maxillary~~ occurs farther back on the shield. The depth and contour of the carina more closely resemble *Vultur* than *Gymnogyps*. A further distinction from *Gymnogyps* is found in the proportions of the element; in *Gymnogyps*, the costal row is longer and the breadth of the shield narrower.

Measurements (in millimeters): length of costal row 43.5-46.9 (*Gymnogyps californianus* 47.4-50.7, *Vultur gryphus* 46.0-49.4); breadth of shield at first intercostal space 71.0-73.8 (*G. californianus* 66.5-72.3, *V. gryphus* 74.3-80.4); ratio (in per cent) of length of costal row to breadth of shield 59.0-64.0 (*G. californianus* 66.6-74.9, *V. gryphus* 61.4-62.0).

as a means of reference in describing
To facilitate the identification of each element, comparisons of breadth
are made with the authors of *Gymnogyps* & *Vultur*. Points of similarity to
other genera are noted in the discussion.

July 26, 1972

STERNUM

Material available: seven incomplete specimens, LACM nos.
(illus)
B1428*, B1517, B3071, B3372, B3783, B4554, B5669.

Description: The carina is deeper in Breagyps than in Gymnogyps, and its ventral contour is nearly straight. Posteriorly it ascends abruptly at the level of the last costal process. In Gymnogyps the ventral margin of the carina is gently convex and the posterior ascent is well back of the level of the last costal process. Vultur more nearly resembles the fossil in depth of carina and contour of its ventral margin, but the posterior ascent is not as far forward. The length of the costal row relative to the breadth of the shield is approximately the same in Breagyps and Vultur. In Gymnogyps the the costal row is longer and the breadth of the shield narrower.

The posterior border of the sternum is not preserved in any of the Breagyps specimens.

Measurements: ^(in mm) length of costal row Breagyps ^{44.9 M} 43.5-46.9 ^{g. ampl. 52.3 M}, ^{49.0 M} 50.0-54.6 ^{47.7 M}, Gymnogyps californianus 47.4-50.7 ^{72.3}, Vultur gryphus 46.0-49.4 ^{g. ampl. 71.1}, breadth of shield at first intercostal space B. clarki 71.0-73.8 ^{70.2-73.5}, G. californianus ^{69.0} 66.5-72.3, V. gryphus ^{77.1} 74.3-80.4; ratio (in per cent) of length of costal row to breadth of shield B. clarki ^{61.8} 59.0-64.0, G. californianus ^{76.2} 66.6-74.9, V. gryphus ^{64.7 M} 61.4-62.0. ^{g. ampl. 73.3 M} ^{68.0-77.5}

	<u>Breagyps</u>	<u>G. calif.</u>	<u>V. gryphus</u>
A Depth of carina	43.5-46.9	47.4-50.7	46.0-49.4
B Breadth shield at 1st intercostal space	71.0-73.8	66.5-72.3	74.3-80.4
Ratio B/A	59.0-64.0%	66.6-74.9%	61.4-62.0%

STERNUM

Material available: seven incomplete specimens, LACM nos. B1428*, B1517, B3071, B3372, B3783, B⁴554, B5669. The carina is complete in three

Description: The ventral margin of the carina slopes down gradually from the anterior end (with a ^{nearly} straight, not rounded contour) to a point at the level of the posteriormost costal process, ^{where} then ^{it then} ascends rather abruptly. In Gymnogyps the ventral margin is gently convex and the ascent occurs well posterior to the costal row. The condition in Vultur ~~is~~ more closely resembles Breggyps but the contour is more rounded and the ascent less abrupt and occurs posterior to the last costal process. ^{Coragyps is quite similar to Vultur but ascent more abrupt}

Description: The carina is deeper than in Gymnogyps and the ventral margin is nearly straight, not ~~broadly~~ convex; posteriorly ~~the~~ it ascends abruptly at the level of the posteriormost costal process; in Gymnogyps the ^{posterior} ascent ~~is much more gradual~~ begins well behind the last costal process, ~~and is more gradual~~ ^{in depth of carina and contour of ventral margin} Vultur and Coragyps more nearly resemble the fossil but in neither is the ascent as far forward. The lateral margins of the coracoidal sulcus are broadly rounded as in Vultur; in Gymnogyps they are narrow ^{in Coragyps they have a moderate flare} and pointed. [^] The intermuscular line on the shield (seen in lateral view) is nearly straight from the ventral lip of the coracoidal sulcus to the base of the carina. In ~~both~~ Gymnogyps, Breggyps and

Coragyps the line describes an elongated S curve (as seen on the ^{San. shaytan} right side). ^{The length of the costal row relative to the breadth of the shield is less than in Vultur} ~~and resembles Vultur~~

	Ratio Breadth of shield to ht. of carina	Length costal row to ht. of shield
<u>Breggyps</u>	98.5% - 98.3	63.6% - 60.3
<u>Gymnogyps</u>	97.7% - 100%	72.5% - 73.5
<u>Vultur</u>	102.6 - 103	61.8 - 60.0

approximately the same as in Vultur but 10% less than in Gymnogyps

51,7

49,9

49,5

48,4

54,4

50,2

6)3041

50.7

712 ⁷54990
4984

727 ^{70.1}510.0
508.9
1100

Carnus medialis

B3372 B455 B566 (B1, B3071 x 9 acino)

Each end 11.1, 7.5, 7.6 apart
(375)

1973

Coragyps sterre

Ventral labial prominence is undercut by
pneumatic area of sternocoracoid impression
On *Breagyps* the impression is more lateral &
does not undercut the prom.

Prominence is also undercut in *gym.* ^{rather} less so
in *U.* (but impression is closer to prom. than in *B*)
Sar is not undercut but impression is much shallower

~~MINUSCULE~~

FURCULA

Material available: seven incomplete specimens., B2224, B2601, B6035, B8114, B8308~~4~~, B8309*, B8315.

Description: Back of scapular tip, external side of clavicles abruptly depressed with large foramen in the depression.

Description: Lower edge of scapular tip with external swelling. External swelling at lower edge of scapular tip, with abrupt depression above the swelling and large foramen in the depression.

Description: External swelling at lower edge of scapular tip externally, with abrupt depression above the swelling and large foramen in the depression; inflated rim bordering coracoidal fossa flattens abruptly posterior to the intermuscular line extending below the fossa.

Comparisons: The condition of the external side of the scapular tip is not found in either Gymnogyps or Vultur. The inflated rim bordering the coracoidal fossa is more evenly distributed ^{and} the area posterior to the intermuscular line is rounded, not flattened; Vultur is intermediate in this respect between Gymnogyps and ~~Vultur~~ Breagyps.

Neither

See March revision
Feb, 12, 1932

FURCULA

Material available: ^{seven} ~~six~~ incomplete specimens, B2224, B2601, ^{L claw} B6035, ^{R claw} B8114, ^{B8315} B8303*, ^{B8309*} B8309*.

Description: The external side of the scapular tip of the clavicles is abruptly depressed dorsally; in both Gymnogyps and Vultur, ^{the external side of the scap tip} this area is broadly convex, and rounds gradually from ventral to dorsal edge. Distal to the tip, the clavicles are ^{are expanded} more inflated at the ^{anterior} anteriormost curvature in Breagyps than in Gymnogyps, but flatten out ^{then} more abruptly ~~inxxxxx~~ toward the ^{ventral} posterior side where the distal terminus of the ~~large external fossa~~ is ^{6-7 mm} more inset from the ^{ventral} posterior border of the shaft. Vultur is closer to Breagyps in these characters, although the inflation ~~of~~ the anterior ~~xxxxx~~ side is intermediate between the fossil and Gymnogyps. Internally the surface of the clavicles near the scapular tip is more depressed in Breagyps and Vultur than in Gymnogyps.

~~Of the 3 genera, Gymnogyps has the least~~ ^{of Gymnogyps the least} ~~the clavicles are much less expanded at the anterior curvature in Gymnogyps~~

Of the 3 genera, Gymnogyps has the least ^{anterior ant.} ~~anterior~~ inflation of the clavicles over the ext fossa, but ~~retains~~ the inflation further toward the posterior border, the fossa being inset only 3-4 mm at its termination. Vultur is closer to Breagyps.

Distance from fossa to post. border 6-7 mm. Breagyps, 3-4 mm. Gymnogyps.

March 14, 1972

FURCULA ^{seven incomplete}

Material available: ^③ Right calvicle B8114, B2601; ^② left calvicle, B8315, B2224; symphysis B6035; in mount B8308 and B8309. ^①

Description: Immediately back of the scapular tips, the dorsal half of the external side of the clavicles is abruptly depressed with a large foramen in the depression. This condition is not duplicated in either Gymnogyps or Breagyps. Distal to the tip, the external surface of the clavicles forms an inflated rim around the anterior edge of the large fossa, but ^{is abruptly} flattened ~~abruptly~~ posterior to the intermuscular line that extends below the fossa. In Gymnogyps, the inflation is more evenly distributed and the area posterior to the intermuscular line is rounded, not flattened; Vultur is ^{in this respect} intermediate between Gymnogyps and Breagyps.

Material available: Twelve right, B1495*, B1499, B1739 (illus) B2311, B3424, B6188, B6320, ~~B72~~B7124, B7699, B7847, B8039, B8376; nine left, B1638, B2644, B3242, B3821, B7067, B7479, B7743, B7914, H3837* (?)Upper end ~~B7~~P1879.

Description: Head more prominently developed posteriorly than anteriorly, with deep, short ligamental attachment on its external surface; furcular facet deep proximo-distally with ~~deep~~ diagonal depression which emphasizes the prominence of the posterior portion of the head; brachial tuberosity projecting anteriorly over deep fossa bordered externally by descending flange of bone and internally by the sharply ridged edge of the triosseal canal; lower border of furcular facet concave near posterior edge, slightly overhanging depressed triosseal canal at this point. In Gymnogyps the head is evenly rounded, the ligamental attachment longer and narrower; the furcular facet is shallow with only a trace of a diagonal depression; brachial tuberosity less prominently projected and the pneumaticity below it anteriorly does not form as deep a fossa; anterior border of triosseal canal is rounded, not acute; the lower border of the furcular facet is straight (not concave) and does not overhang the triosseal canal. IN Vultur, ~~the head is evenly rounded, the furcular facet, though as deep as in Breagyps has no diagonal depressions; its lower border is straight but has a slight overhang; the brachial tuberosity is even more prominent than in Breagyps with deeper fossa beneath; the triosseal border is less acute than in Breagyps though not as rounded as in Gymnogyps.~~ the head is evenly rounded, the furcular facet, though as deep as in Breagyps has no diagonal depressions; its lower border is straight but has a slight overhang; the brachial tuberosity is even more prominent than in Breagyps with deeper fossa beneath; the triosseal border is less acute than in Breagyps though not as rounded as in Gymnogyps.

Measurements: Length just mediad of sterno-coracoidal angle 95.7-102mm; breadth across triosseal canal 20.3-21.8mm; depth of furcular facet 12.6-15.2; ratio of height of furcular facet to breadth across triosseal canal 60.0-71 per cent (50.7-58.7% in Gymnogyps, 65.6-70.5% in Vultur).

neither

CORACOID

Review this with *March 14, 1972*
Q. amplus

Material available: Twelve right, B1495* B1499, B1739 (illus),
B2311, B3424, B6188, B6320, B7124, B7699, B7847, B8039, B8376;
nine left, B1638, B2644, B3242, B3821, B7067, B7479, B7743, B7914,
H3837*. *Upper and F1879*

is this in collection?
Description: The anterior border of the triosseal canal is sharply acute, the anterior edge of the furcular facet projects markedly over a deep fossa ^{*perfected with pneumatic foramina and*} ~~which is~~ bordered externally by a ^{*prominent*} descending flange of bone; the border of the furcular facet above the triosseal canal is concave in outline near the posterior edge ~~and slightly overhangs the canal at this point~~; the ^{*furcular facet*} head is deep ^{*proximal*} and a diagonal depression through the ~~furcular~~ facet results in giving particular prominence to the posteriormost portion of the head as seen in internal view. In *Gymnogyps*, the anterior border of the triosseal canal is rounded, the pneumaticity below the anterior edge of the furcular facet does not form a deep fossa, the lower border of the furcular facet is straight ^{*(not concave)*} ~~with no overhang~~, and the ^{*facet*} head is shallow with only a slight depression through the furcular facet. In *Vultur*, the anterior border of the triosseal canal is less acute than in *Breagyps*, but not as rounded as in *Gymnogyps*; the furcular facet projects farther anteriorly, and the fossa below the facet is deeper ^{*with*} ~~and~~ the ^{*border*} descending flange of bone of greater extent; the lower border of the furcular facet is straight ^{*downward*} ~~with~~ a slight overhang; the ^{*facet*} head is equal in depth to *Breagyps* but is more evenly rounded, with no diagonal depression.

Measurements: Length, just ^{*medial*} ~~back~~ of ^{*the sterno-coracoid angle*} internal point 95.7-102 mm; breadth across triosseal canal 20.3-21.8 mm; depth of head ~~width~~ from ^{*height*} lower edge of furcular facet 12.6-15.2 mm; ratio of ^{*height of furcular facet*} depth of head to breadth ^{*across*} ~~width~~ of triosseal canal, 60.0-71 per cent (50.7-58.7 percent in *Gymnogyps*, 65.6-70.5 per cent in *Vultur*).

CORACOID

Feb 1972
Mar 1, 1972 (female)

Material available: 12 right, B1495*, B1499, B1739 (illus.), B2311, B3424, B6188, B6320, B7124, B7699, B7847, B8039, B8376; 9 left, B1638, B2644, B3242, B3821, B7067, B7479, B7743, B7914, H3837*.

Description: ^①The anterior border of the triosseal canal is sharply acute, the ^②anterior edge of the furcular facet projects markedly over a deep fossa which is bordered externally by a descending flange of bone; ^③the border of the furcular facet above the triosseal canal is concave in outline near the posterior edge and slightly overhangs the canal at this point. In Gymnogyps the ^①anterior border of the triosseal canal is rounded, the ^②furcular facet projects ^{anteriorly} only slightly, if at all, and there is only slight ^{the} pneumaticity below the ^{anterior edge of the furcular} facet; ^③the lower border of the furcular facet is straight with no overhang.

In Vultur this border is straight but has a slight overhang; the anterior border of the triosseal canal is less acute than in Breagyps but the ^②furcular facet projects farther anteriorly, the fossa below the facet is deeper and the descending flange of bone of greater extent; ^③The lower border of the furcular facet is straight with a slight overhang. ^④The head is relatively deeper in Breagyps than in Gymnogyps. A diagonal depression through the furcular facet in Breagyps results in giving particular prominence to the posteriormost portion of the head as seen in internal view; ^{The depression} This condition is less marked in Gymnogyps; in Vultur the head is more evenly rounded than in either Breagyps or Gymnogyps but is equal to Breagyps in rel. depth.

At the sternal end, the sternocoracoidal depression is deeper in Breagyps than in Gymnogyps and undercuts the sternal facet along its external half. The depression is deep in Vultur but does not undercut the facet as markedly as in the fossil. The sternocoracoidal process has a broad, short external surface in contrast to a longer, narrower surface in both Gymnogyps and Vultur.

Procoracoid?

depth of head
meas. from forward edge
of face, point 60-70%
of br. below point

meas. with 1 bar
calipers
straight across
the lower
edge of the
precoracoid
facet

October 23, 1971.

CORACOID

Material available: 12 right, B1495*, B1739^(illus), B8039, B3424, B6188, B7847, B8376, B1499, B6320, B7699, B7124, ^{B1311 where are they?} ~~B1311~~ ^{but close} 9 left, H3837*, B7067, B7914, B7743, B2644, B7479, B1638, B3821, B3242.

Description: Distinguished from Gymnogyps in sharply acute anterior border of triosseal canal, deep fossa below projecting anterior edge of furcular facet bordered externally by a descending flange of bone, and border of furcular facet above triosseal canal concave in outline near posterior edge and slightly overhanging the canal at this point. In Gymnogyps the anterior border of the shaft is rounded, the furcular facet projects only slightly if at all and there is only slight pneumaticity below the facet; the lower border of the furcular facet is straight, with no overhang. This border is also straight in Vultur, but has a slight overhang; ^{also in Vultur} the anterior border of the triosseal canal is less acute than in Breagyps but the fossa below the anterior end of the furcular facet is deeper the facet projecting farther anteriorly and the descending flange of bone of greater extent.

A diagonal depression through the furcular facet in Breagyps results in giving particular prominence to the posteriormost portion of the head as seen in internal view. This condition is less marked in Gymnogyps; ~~and~~ in Vultur, the head is more evenly rounded than in either Breagyps or Gymnogyps.

^{proximally} ~~Distally~~ the sternocoracoidal depression is deeper in Breagyps than in Gymnogyps, and undercuts the sternal facet along its external half. The depression is deep in Vultur but does not undercut the facet so markedly as in the fossil.

The external process at the sternal end presents a short broad external surface, in contrast to a ^{longer} narrower surface in both Gymnogyps & Vultur.

*Coragyps
close
Breagyps*

Coracoid continued October 23, 1971

Measurements: Length of coracoid to sternal facet, just lateral to internal distal angle, *Breagyps* (10 specimens) 95.4 - 101.8 mm, mean 98.7 mm.; *Gymnogyps californiensis*, 92.9- 98.9 mm., 96.4 mm mean; *Vultur gryphus* (2 specimens) 27.5 - 31.6 mm.; greatest breadth head, *Breagyps* ^(7 specimens) 22.7 - 25.4, mean 24.1; *G. californiensis* ^(8 specimens) 24.0- 26.2 mm, mean 24.7 mm; *V. gryphus* ^(2 specimens) 27.5-31.6 mm.

- ① Anterior margin of shaft below head sharply acute rather than rounded. [Gymnocypris is rounded.]
- ② Deep pneumatic fossa below anterior margin of head formed by a markedly protruded area of the furcular facet and ^{sup?}basal attachment followed by a descending flange of bone which parallels the anterior margin of the shaft externally. [The area below the head is rounded in Gymnocypris with no protrusion of ^{marginal}basal attachment area; only slight pneumaticity exists.]
- ③ Furcular facet obliquely depressed, resulting in posterior portion of head being more prominently produced proximally. [Head has more evenly, broadly rounded contour in Gymnocypris.]
- ④ Lower margin of furcular facet well marked and slightly projecting above shaft; contour of margin slightly concave. [In Gymnocypris the facet's margin recedes slightly from shaft & is less clearly marked and straighter in contour.]
- ⑤ Sternocoracoidal depression deeply incised along border of ~~furcular~~ ^{sternal} facet ^{towards} its external extremity. [Not incised in Gymnocypris.]
- ① & ② Angular ^{ant.} margin of shaft and pneumatic fossa below ant. margin with descending flange of bone all duplicated in V. ^{but more pronounced} ~~Gymnocypris~~ ^{Gymnocypris}.
- ③ & ④ Lower margin of furcular facet is well marked & slightly projects beyond shaft in V. ^{as} ~~Gymnocypris~~ ^{Gymnocypris}, but the facet is not obliquely depressed so head is not as prominent as in Brachyops. ^{in V. ~~Gymnocypris~~}
- ⑤ Sternocoracoidal depression is not as deeply incised at its ext. edge as in Brachyops but more so than in Gymnocypris.

Coraciids & Coragyps, Cathartes + Vultur +
Sept 1971
Sarcoraptes vs. Bregia.

- ① ~~Bregia~~ Vulture angular, Coragyps very angular
Sarcoraptes moderately angular; Cathartes more rounded
but not as much as in Gymnogyps.
- 2 Pneumatic fossa. present in all genera above noted
(but not in Gymnogyps). However ~~but not attached~~
+ furcular facet does not protrude in Cathartes. It does in
Coragyps, Sarcoraptes + Vulture.
- ③ Tendency to the oblique depression in Sarcoraptes, ~~vulture~~
+ Coragyps. Cathartes differs from all in even ~~point~~ ^{contour}
contour rises to a point.
- ④ Lower margin of furcular facet well marked + projects
in all above genera (but not Gymnogyps). Coragyps is deeply
deeply depressed below the facet.

Summary of comparisons with all Recent genera:

~~Distinguishing~~ Cathartes has pointed head, lacks
overhanging furcular facet anteriorly

Coragyps, much greater depression below furcular facet
sul. narrow furcular facet (which does, however protrude
anteriorly as in Bregia). Foramen below procoracoid
very thin bordered with bone (quite close to edge) more so
than any other genus includes Bregia.

Sarcoraptes (Vulture ^{next} nearest to Bregia). Depth of head
more like Vulture (thinner in Sarcoraptes) Depth is
as divided into high + low portions (by oblique division)
as in Bregia, not more so than Gymnogyps.

External flange at sternal end is like Vulture
more knob like in Coragyps, Cathartes + Sarcoraptes

Gymnogyps?

CORACOID

check RTL

Material available: Eleven right, ¹⁰ ~~one~~ left nearly complete,
nos. B1495*, H3837*, B1499, B6320, B7699, B7124, B8039, B3484,
B6188, B2311, B7847, B8376, B7067, B7914, B7743, B2644, B7479,
B1638, B3821, B3242, B1739 (photo) (supra) (inferior) (lateral) (medial)

Description: Anterior margin of shaft below head sharply acute, and deep pneumatic fossa below anterior margin of head formed by a markedly protruded are of the furcular facet and bicipital attachment followed by a descending flange of bone parallelling the anterior margin of the shaft. Resemblance is closer to

Vultur, Corag ps. and Sarcoramphus than to Gymnogyps; In Gymnogyps of the area ~~of~~ the shaft margin is rounded and there is no protrusion of the bicipital attachment. The furcular facet is obliquely depressed,

the posterior portion of the head being more prominently produced proximally; the lower margin of the facet is well marked

and projects slightly from the ^{axial canal} area below ~~the head~~ ^{the head} ~~has a~~ ^{contains the}

is more even and broadly rounded in Gymnogyps, the margin of the furcular facet is ~~straighter~~ and less clearly marked, but appears straighter and recedes slightly from the area below. ~~The resemblance is closer to Sarcoramphus & Corag ps. with the contour of the head. The lower margin of the facet is well marked & projects in Vultur and Corag ps. but in the latter the furcular canal area is much more deeply depressed. The contour of the head is.~~

Sterno coracoidal depression deeply incised along border of sternal facet towards its external extremity in Baeagyps but not in Gymnogyps.

In all the above characters Baeagyps tends to resemble Vultur and Corag ps. ~~Sarcoramphus~~ more closely than Gymnogyps. ~~On Corag ps. however the furcular facet is more obliquely depressed. canal area is more deeply depressed & the furcular facet is not however through Sarcoramphus with presence of the pneumatic fossa below the ant. margin of the furcular facet~~

CORACOID 11?

Material available: right, , B1739, B8039, B3424,
B6188, B7847, B8376

9? left, *, B7067, B7914, B7743, B2644, B7479, B1638, B3821,
B3242 (nt - B1495, H 3837); other previously listed B1499, B6320,
B37649, B7124

Description: Anterior margin of shaft below head sharply acute,
with deep pneumatic fossa below ~~anterior margin of~~ head formed by
~~a markedly protruded area~~ ^{anterior} ^{sign} of the furcular facet and bicipital
attachment followed by a descending flange of bone paralleling the
~~anterior~~ margin of the shaft. The furcular facet is obliquely ~~deep~~
depressed, the posterior portion of the head being more prominently
produced proximally; the lower margin of the facet is well marked
and projects slightly from the triosseal canal area below. ~~The~~
~~sternocoracoidal depression is deeply incised along the border of the~~
~~sternal facet towards its external extremity.~~ In Gymnogyps the
anterior margin of the shaft is rounded and there is ^{little or} ~~no~~ protrusion
of the ^{furcular facet or} bicipital attachment; the contour of the head is evenly and
broadly rounded, and the ^{lower} margin of the furcular facet is less clearly
marked than in Breagyps ~~but appears straighter~~ and recedes slightly
from the area below. At the sternal end, the sternocoracoidal
depression is deeply incised along the border of the sternal facet
toawrds its external extremity in Breagyps, but not in Gymnogyps;
~~the sternocoracoidal process~~

Cracoid Individually several of the enumerated characters
of Bregia occur in other Vulturid genera, but

compared to Bregia Catantus differs from all others in very pointed head,
~~both~~ anterior borders rising abruptly to a point

Saccorhamphus has less overhang of ^{internal} ~~posterior~~ margin
of furcular facet ^{at its posterior end} ~~and~~ less divided appearance of head &
less overhang of furcular facet on anterior margin

Saccorhamphus has little or no fossa below
anterior edge of furcular facet and the facet descends
gradually (in Bregia & ~~other Condors~~ ^{Vulture} facet ends abruptly
at a squared off edge that overhangs the fossa; Gymnops
bet. Sacco & Vulture Bregia.) On internal facet
the border of the furcular facet is nearly straight with
no overhang. Ant. edged shaft (trochanteral area) rounded

Coragyps similar to Bregia & Vulture in
anterior edge of furcular facet & the fossa below,
also anterior border of shaft (trochanteral area) acute & rounded
furcular facet narrower than Bregia or Vulture
(more like Gymnops but margin of facet more defined
& overhang than Gymnops - approaches Bregia.
Lacks decided diagonal depression of head

	a	b	Ratio	Coracoid	cl	ca	dist	dist	Ratio		
	Length	Am. top	ca	breadth	cl	ca	prot	el	ca		
31	97.4	25.3	26.90	23.0	25.1	91.6	23.7	12.2	48.3	57.6	59.2
31.2	92.1	24.2	26.290	22.6	23.7	95.4	24.5	11.0	45.5	56.8	61.6
269	95.9	24.6	25.690	22.6	23.7	95.4	23.5	12.2	49.2	56.9	59.4
302	96.2	26.0	27.190	24.1	24.7	92.6	25.0	13.0	50.0	57.3	59.5
B1371	92.7	26.2	26.890	24.2	25.2	96.0	24.7	12.7	48.5	58.8	60.2
218	95.0	27.6	29.90	21.6	24.6	81.2	21.7	15.0	54.4	55.4	58.4
737	68.2	15.8	23.190	13.2	15.8	83.6	19.6	8.5	53.4	42.4	62.3
684	71.5	16.6	23.290	14.4	16.7	86.3	20.1	8.7	52.3	43.8	61.3
228	60.2	12.2	20.290	10.	11.7	85.5	16.6	6.9	56.5	39.0	64.7
716	58.2	11.7	20.190	10.6	11.3	93.8	18.2	6.4	54.6	38.7	66.5
18	53.7	11.7	21.790	11.5	12.5	92.0	27.0	7.3	62.3	31.1	57.9
B8039	93.6	22.9	24.490	20.4	22.2	90.4	21.8	12.7	55.5	58.1	62.0
B1499	94.3	23.2	24.6	20.2	22.6	89.4	21.4	13.1	56.4	56.8	60.4
B1739	95.7	24.3	25.390	21.3	23.2	91.7	22.2	14.2	58.4	58.2	60.7
B8376	93.4	26.4	28.290	22.2	24.2	91.7	23.8	13.4	50.7	57.2	61.2
B1914	93.0										
B5382	99.9										
B6188	92.0										

20 specimens

20 specimens

OLD

Internally contour of furcular facet slightly concave due to carway inward of post (dorsal) edge. Other condyles straight tending to converge at cor. a little like the femur

April 18, 1933.

Dr. A. Wetmore, Assistant Secretary
Smithsonian Institution
United States National Museum
Washington, D. C.

Dear Dr. Wetmore:

Coarctis

See former comparisons with S + V.

Sac: rounded ant. contour of this canal, no
onabang of furcular facet ant'ly. Viewed ant'ly, upper
end ^{in 737} a symmetrical incision. V () Furc. facet
sharper & depression below for nearly ^{ant post} whole ant area
(slightly more posterior). In 737 There is a slight onabang
of furc. facet & therefore the upper end is not asym-
metrical as in 735 but more so than B. No external
bulge of head in either 735 or 737 which is found in B.

Coarctis has onabang of facet, deep depression
below facet in this area (deeper than B), ant edge
angular as in B. Coarctis has ^{and more widely} fragile foramen in process.
Bone is very slender.

Cathartes very rounded top of upper end & deep
furc. facet. Very dif from B. Slight onabang of facet
& a deep fossa is present (like B in this) ant edge of
this area rather angular.

~~Clavicle~~ ² Clavicle broadly & evenly rounded
from scapular tip forward

¹ Iurula: Combination of long slender scapular tip
with ~~also~~ ³ swelling on external face ant. to tip with
pneumatic orifice above

1973

Coracoid Crayfish

Narrower furcular facet than B

Lig attach ant ext not as deep

Foramen of process. much closer to edge

Neck less depressed

Lower border of facet straight (but like B
in tendency to overhang in #228, thus
less so.

3 Scapula of *Carapys* ^{acromion}

^{acromion} More flared than ⁱⁿ B but less abruptly flared
from shaft. Flares out well beyond shaft, dorsal
and adjacent ^{well} depressed.

~~Acromion is more produced anteriorly & less ventrally~~

The flange of the acromion goes farther forward
but the vent. ant. prominence is less.

SCAPULA

Jul 1972

Material available: six right, B1657, B1670, B1676, B3420, (illus)
B4450 (illus), B4862*; seven left, B1671, B2259, B3482, B4418,
B6020, B6332, B7558*.

Description: ^{viewed dorsally} Compared with Gymnogyps, the acromion in Breagyps
arises from the shaft more abruptly and is more deflected ^{than in Gymnogyps} mediad
(~~as viewed dorsally~~); the proximal contour (~~viewed dorsally~~) is nearly
straight, with the coracoidal articulation flattened and the anterior
contour of the acromion broadly rounded. In Gymnogyps ^{acromion less deflected} the coracoidal
articulation is more convex, and the ^(Antio-muharara) acromion is more acutely
produced anteriorly. The acromion arises abruptly from the shaft
in Vultur but is not deflected mediad, and is even more markedly
produced ^{anteriorly} ~~anteriorly~~ than in Gymnogyps.

Measurements: Greatest breadth from acromion to glenoid facet,
Breagyps (9 measured specimens) 28.7 - 32.2 mm, mean 30.3mm;
Gymnogyps californiensis (8 specimens) 27.6 - 30.5 mm, mean 28.8 mm
Vultur gryphus (2 specimens) 26.8 - 29.8 mm.

SCAPULA

Material available: six right, B4862*, B4450, B1657, B1676,
B3420; seven left, B1670

October 23, 1971

SCAPULA

Material available: six right, B4862*, B4450^(photo), B1657, B1676, B3420, B1670; seven left, B7558*, B4418, B2259, B1671, B6332, B3482, B6020.

Description: Compared with Gymnogyps, the acromion^{in Bregypus} arises from the shaft more abruptly and is more deflected mediad (as viewed dorsally), ~~the area between the acromion and the glenoid facet is more deeply depressed~~, the proximal contour (viewed dorsally) is nearly straight with the coracoid articulation flattened and the anterior contour of the acromion broadly rounded. In Gymnogyps the coracoid articulation is more convex, and the acromion is more acutely produced anteriorly. The acromion arises abruptly from the shaft in Vultur but is not deflected mediad and ~~the area between the acromion and the glenoid is shallow; the~~ ^{and} ~~acromion~~ is even more markedly produced anteriorly than in Gymnogyps.

Measurements: Greatest breadth from acromion to glenoid facet, Bregypus (9 measured specimens) 28.7 - 32.2 mm., mean 30.3 mm;
Gymnogyps californiensis (8 specimens) 27.6 - 30.5 mm., mean 28.8 mm.
Gymnogyps amplus
Vultur gryphus, (2 specimens), 26.8 - 29.8 mm.

*Cratichneumon
very different*

The acromion in Cratichneumon does not arise abruptly & the whole acromion flares more anteriorly, with deep dorsal depression mediad ^{between acromion & glenoid facet}

The acromion ridge is slightly separated from ~~coracoid articulation~~ ^{in Cratichneumon} portion of the bone that contacts the ~~coracoid~~ ^{coracoid}. It differs from all others in abrupt projection of the glenoid facet. Saccorhamphus rather like Gymnogyps

SCAPULA

Aug 1971

Material available: six right, ~~xxxxxxx~~ nos. B4862*,
^RB4450, ^RB1657, ^RB1676, ^RB3420, ^RB1670; seven left, nos. B7558*, ^LB4418,
^LB2259, ^LB1671, ^LB6332, ^LB3482, ^LB6020.

Description: The acromion rises from the shaft abruptly and is markedly deflected dorsally. In ~~Gymnogyps~~ and Sarcoramphus the acromion arises more gradually and is less abruptly deflected, in Vultur, ~~also~~, the dorsal deflection is less, but the acromion arises abruptly; in Coragyps the acromion is deflected dorsally, but is more projected anteriorly than in Breagyps.

Description: The acromion arises from the shaft abruptly and is more medially deflected as viewed dorsally than in ~~Gymnogyps~~ and Sarcoramphus. The anterior margin broadly rounded and and is markedly deflected dorsally; the ~~anterior~~ medial ~~edge~~ ^{lacking prominent tubercle at the medial edge} of the anterior margin is not markedly protruded. In Gymnogyps and Sarcoramphus the acromion arises more gradually and is less abruptly deflected dorsally, and in ~~Gymnogyps~~ the median edge of the anterior contour protrudes as a definite tubercle. IN Vultur, the acromion arises abruptly but is less deflected dorsally; ~~the anterior contour~~ ^{medial edge} protrudes even more markedly anteriorly than in ~~Gymnogyps~~. In Coragyps the acromion is shorter, ^{and} very deflected dorsally and ~~prominently projected anteriorly~~. Intermuscular line ^{acromion} on ventral side of ~~shaft~~ extends across the acromion to terminate laterally at its distal edge, as in Gymnogyps. In Vultur the line descends down the shaft, terminating distal to the acromion.

all of these Recent genera
 In ~~Gymnogyps~~, Vultur, Sarcoramphus, Coragyps, the ~~anterior~~ ^{the acromion} median edge is more prominently projected anteriorly, even forming a definite tubercle in Gymnogyps.

- ① Acromion arising from shaft abruptly, ~~marked~~ ^{and with} median deflection ~~arising dorsally~~ ^{area between acrom. & glenoid well depressed} deflected dorsally. [Gymnogyphs acromion arises more gradually and is less abruptly deflected] ^{area between is less depressed}

- ② Proximal contour ^{from glenoid facet to acromion} (curved from dorsal side)

nearly straight, with coracoid articulation flattened ^{median edge} and anterior ^{contour of acromion} ~~edge of median edge~~

~~broadly rounded~~ ^{not protruding as a definite tubercle}

[Gymnogyphs has more rounded, distinct ^{convex (all edges)} coracoid articulation and ^{anterior} median edge of acromion ^{has a prominent tubercle like protrusion} protrudes on proximal contour as a definite tubercle (viewing from contour from dorsal side)]

and more prominent ^{protrusion} ant. contour of acromion

- ① Vulturgyphus acromion arises abruptly, but is less deflected ~~dorsally~~ ^{medial} and area between acromion & glenoid ^{only slightly depressed}

- ② Coracoid articulation flattened (?) but ^{anterior} median edge of acromion ^{more so} ~~protrudes even more markedly~~ ^(than in Gymnogyphs)

- ③ Muscle line on ventral side extends across acromion terminating laterally at the distal edge of the acromion [Situation is similar Gymnogyphs, but in Vultur the line descends down the shaft, terminating distal to the distal edge of the acromion]

Cathartes very small, prominent scap. facet, short, not from acromion
 Caragys short but prominent acromion very deflected dorsally
 & depressed with orificis (projects ant'ly more than Brachyops)
 Suro not as abrupt & takes off acromion from shaft as in
 Brachyops not as deflected dorsally

$$\begin{array}{r} 175 \\ 28.0 \overline{) 2100.0} \\ \underline{1960} \\ 1400 \\ \underline{1400} \\ 0 \end{array}$$

$$\begin{array}{r} 68.5 \\ 29.6 \overline{) 2030} \\ \underline{1776} \\ 2540 \\ \underline{2368} \\ 1730 \end{array}$$

$$\begin{array}{r} 71 \\ 30.2 \overline{) 2150} \\ \underline{2114} \\ 360 \\ \underline{3580} \\ 20 \end{array}$$

$$\begin{array}{r} 75.4 \\ 30.9 \overline{) 2330} \\ \underline{2163} \\ 1670 \\ \underline{1545} \\ 1250 \end{array}$$

$$\begin{array}{r} 74 \\ 29.9 \overline{) 2240} \\ \underline{2096} \\ 1440 \\ \underline{1196} \\ 44 \end{array}$$

30.

$$\begin{array}{r} 75 \\ 280 \overline{) 2100} \\ \underline{1960} \\ 1400 \\ \underline{1400} \\ 0 \end{array}$$

$$\begin{array}{r} 744 \\ 282 \overline{) 2100} \\ \underline{1974} \\ 1260 \\ \underline{1128} \\ 1320 \\ 10 \end{array}$$

$$\begin{array}{r} 69 \\ 30.6 \overline{) 2050} \\ \underline{1836} \\ 2140 \\ \underline{2142} \\ -2 \end{array}$$

$$\begin{array}{r} 66 \\ 306 \overline{) 2080} \\ \underline{1836} \\ 1440 \\ \underline{1418} \\ 22 \end{array}$$

$$\begin{array}{r} 812 \\ 29.8 \overline{) 2430} \\ \underline{2394} \\ 360 \\ \underline{3580} \\ 20 \end{array}$$

$$\begin{array}{r} 26.8 \\ 312 \overline{) 2200} \\ \underline{2184} \\ 160 \\ \underline{1584} \\ 160 \end{array}$$

$$\begin{array}{r} 22.0 \\ 260 \overline{) 2200} \\ \underline{2180} \\ 200 \\ \underline{1932} \\ 2680 \end{array}$$

$$\begin{array}{r} 721 \\ 276 \overline{) 2020} \\ \underline{1932} \\ 880 \\ \underline{828} \\ 520 \end{array}$$

$$\begin{array}{r} 73 \\ 298 \overline{) 2180} \\ \underline{2086} \\ 940 \end{array}$$

$$\begin{array}{r} 72 \\ 305 \overline{) 2200} \\ \underline{2135} \\ 650 \end{array}$$

$$\begin{array}{r} 721 \\ 280 \overline{) 2020} \\ \underline{1960} \\ 600 \\ \underline{560} \\ 400 \end{array}$$

$$\begin{array}{r} 74 \\ 291 \overline{) 2150} \\ \underline{2057} \\ 930 \\ \underline{927} \\ 30 \end{array}$$

$$\begin{array}{r} 721 \\ 160 \overline{) 1210} \\ \underline{1120} \\ 900 \\ \underline{880} \\ 20 \end{array}$$

$$\begin{array}{r} 749 \\ 299 \overline{) 2240} \\ \underline{2093} \\ 1470 \\ \underline{1196} \\ 2740 \end{array}$$

$$\begin{array}{r} 721 \\ 30.5 \overline{) 2200} \\ \underline{2135} \\ 650 \\ \underline{610} \\ 400 \end{array}$$

HUMERUS

July 30, 1972

Material available: five nearly complete B3246*, B8002, B5329 + B4847 (proximal and distal ends of the same bone) and B7739 + B7737 (also proximal and distal ends of one bone); five proximal ends B1583, B2083, B2156, B4954, B5917; three distal ends B2034, B5956, and B7247.

Description: In anconal aspect the ^{deltoid} pectoral crest in Breagyps is more heavily bordered and medially depressed immediately ^{distal to} below the external tuberosity than in either Gymnogyps or Vultur. On the palmar side the scar at the distal tip of the pectoral crest is close to the external edge of the shaft as in Vultur; in Gymnogyps the scar is inset medially. Also similar to Vultur is the broad, shallow depression of the bicipital furrow with only a slight pneumatic depression immediately below the head; in Gymnogyps the bicipital furrow is more depressed and there is marked pneumatic depression at the base of the head. Distally, there are deep pneumatic fossae adjacent to both internal and external condyles which undercut the base of the external condyle and ectepicondylar process on the ~~external side~~ ^(on internal side) and the attachment of the anterior ligament on the ~~internal side~~. Neither of these fossae appear in Vultur; in Gymnogyps the internal fossa and undercutting are well marked, but in ^{ob} only one specimen out of 6 Recent specimens and ^{over 50?} an equal number of bones from Rancho La Brea is the external area likewise affected. Observed in external view, the ectepicondylar process is broad in Breagyps with only slight curvature. The curvature is the same in Gymnogyps, but the process is narrower; in Vultur the process is ^{not only} narrower and ^{markedly} curved anconal at its proximal tip.

Measurements (in millimeters): greatest length, B. clarki 256-260; G. californianus 269-275, V. clarki 272-280; proximal breadth through bicipital crest B. clarki 57.3-60.3, G. californianus 54.6-58.3, V. gryphus 57.9-62.1; greatest breadth distal end B. clarki 46.7-48.9, G. californianus 46.2-47.8, V. gryphus 49.5-52.3.

Bicipital crest rounded distally with shaft crest

X? 2034

March 14, 1952

HUMERUS

Two

Material available: ~~2~~ complete right B3246* and B7737+B7749

(one bone, proximal and distal ends found and numbered separately),
~~2~~^{two} Complete left B7730 and B8002; one right lacking proximal tip
B7247; three right proximal ends B1583, B4954, B5329 (illus),
four left proximal ends B2083, B2156, B5917, B6318; three right
distal ends ~~B2034~~, B4847 (illus) B5956.

Isolated well list
B5914 distal
B3396 prox

Description: ¹Bicipital crest broadly and evenly rounded, the
bicipital surface not sharply delineated distally; ²scar at distal tip
of pectoral crest close to external edge of shaft; ³bicipital furrow is
broad and ^{shallow with slight pneumatic depression immediately below the head} only slightly depressed; medial edge of median crest com-
paratively straight and capital groove well depressed and broad as it
opens onto the shaft; ^{in an axonal aspect the pectoral crest is heavily bordered & medially depressed} distally, a deep pneumatic depression between
the external condyle and the base of the ectepicondylar process, under-
cutting the sharply defined edge of the condyle; ^{the}ectepicondylar
process, observed in external view, broad with only slight curvature;
deep pneumatic depression above the internal condyle and undercutting
the attachment of the anterior ligament.

distally, deep pneumatic depressions occur
above the int. condyle, undercutting the attach-
ment of ligament and between the ext. cond-
& the base of the ectepi proc. undercutting the sharply
defined edge of the condyle

In Gymnogyps the bicipital crest is ^{doesn't hold} more unevenly contoured
(less broad and round) and the distal contour of the bicipital surface
is distinctly raised above the shaft; the scar at the distal tip of
the pectoral crest is inset from the external edge of the shaft; the
bicipital furrow is slightly more depressed in Gymnogyps and there is
a marked pneumatic depression at the base of the head; the medial edge
of the median crest is rounded, the depression of the capital groove
is similar in Gymnogyps and Breagyps but the groove is more constricted
at its junction with the shaft in Gymnogyps. Distally, one specimen
of Gymnogyps californiensis has a tendency to pneumaticity in the
area between the condyle and ectepicondylar prominence but the condyle
is not completely undercut and the border is not clearly and sharply
marked (two other Gymnogyps specimens are not undercut at all);

most Gymnogyps bones are not undercut at all

above the internal condyle, *Gymnogyps* has a deep pneumatic depression as in *Breagyps*; the ectepicondylar process has the slight curvature found in *Breagyps* but the process is narrower.

characters
In *Vultur* the ~~scapular crest and distal extension~~ of the and bicipital furrow bicipital crest ~~and~~ bicipital surface/are similar to *Breagyps*; the position of the scar at the distal end of the pectoral crest is also similar ~~to that of Breagyps~~; the medial edge of the median crest is more rounded; distally, the external condyle has a sharply defined edge but there is less undercutting than in *Breagyps*, ^{and} there is no undercutting of the internal condyle, and only a slight depression above the ~~condyle~~; the ectepicondylar process is narrow and the proximal tip curves markedly anteriorly.

Measurements: greatest length 255- ^{275?} 268 mm; proximal breadth ~~distance from head to distal tip of pectoral scar~~ ^{136.7 mm (V.)} through bicipital crest 57-~~64~~ mm; greatest breadth of distal end 46.7-48.9 mm. A humerus ^{of Breagyps} from Smith Creek Cave loaned by the Nevada State Museum has a distal breadth of 50.2 mm. and an overall length of over 290 mm. and dist. from head to pect. scar of 133.8 mm.

297 mm. - length of humerus from Smith Creek Cave
property of Nevada State Mus.
50.2 mm
br. dist. end; 22.5 br. mid shaft, 133.8 head to pect. scar

123.5 - head to end pectoral crest in 2nd
humerus from Smith Creek Cave
prop. Nev. St. Mus.

23.5 - br. shaft

136.7 head to end pect. crest
in largest RLB specimen 136.5 ^{8?} (*Gymnogyps*?)

21.5 br. sh. RLB 87245 *Breagyps*

from Old notes; → Check attach. latissimus dorsi muscle. Is it
re: prox end more prominent than in g.? (8. flattened?)
Attach. infraspinatus depressed back from edge
(with angular edge)
Pneumatic fossa broad but inclined to be shallow
shaft curves as in g. (V. straighter)

Nov. 1, 1971

See March
1972
rewrite

HUMERUS

Material available: Complete, 2 right, B3246* and B7737 +
1 right complete except for proximal end B7247
B7739, 2 left B8002 and B7730; /proximal end, 3 right, B5329, B4954,
B1583, 4 left ~~B4847~~, B6318, B2083, ~~B5329 (illus)~~ B5917, B2156;
4 right distal

Material available: Complete (right) B3246* and B7737 + B7739.
(left) B8002 and B7730; incomplete (proximal end missing) B7247,
(proximal end only) ~~B4847~~ (right) B5329 (illus), B4954, B1583, (left)
B6318, B2083, B5917 and B2156; distal end only (right) B4847 (illus),
B5956, B2034, ~~B7247 distal~~ (see above)

*distal?
B5914 where?
(int. 2?)*

~~On the~~ ^{antral} aspect the pectoral crest is more
heavily bordered & medially depressed than in *Vultur*
of *Gymnophis*; the ^{medial edge of the} median crest is straighter.
The capital groove is well depressed as in *Gymnophis*
but opens onto the shaft more broadly than in that
genus. In palmar aspect the scar at the tip of the pectoral crest is done to the edge of the
transverse process.
Distally, there is a deep pneumatic depression
between the ext condyle & the base of the ectepicondylar
process which undercuts the sharply defined edge of the condyle
there is some variation in this ~~pneumatic depression~~ in *Vultur*
Gymnophis, but ~~with which~~ *Vultur* has a ~~more~~ ^{sharper}
defined border of the ext. condyle, *Gymnophis* does not.

Internally there is a deep pneumatic depression above the
internal condyle which undercuts the attachment of the ant. ligament.
Resemblance to *Vultur* is closer in the sharp definition
of the ext. condyle, but closer to *Gymnophis* in the
undercutting of the ant. ligament.

The ectepicondylar process (observed in ext view) is broad
& has only slight curvature; it is narrower in both
Gymnophis & *Vultur* & in the latter it is markedly curved at the
prox tip

Humerus

Description: ~~In the following char. of this element~~
~~Similar to Gymnagyps in curvature~~
~~of shaft, but in~~ ~~Except for greater curvature of the~~
~~shaft, the humerus of~~ ~~Beagys~~ ^{more closely} resembles Vulture
~~more~~ than Gymnagyps: The bicipital crest is
broadly & evenly rounded, ~~and the bicipital surface~~
~~not sharply delineated.~~ ^{The bicipital furrow broad & only slightly defined} The "tear-drop" shaped ~~at the tip~~
at the tip of the pectoral crest is lateral close to the
external edge of the shaft and, more proximally, the attachment
~~the pectoral attachment~~ ~~broader portion of the pectoral attachment~~
narrows to meet the outer edge of the crest at a point
slightly proximal to the level of the distal contour of the
bicipital crest

In the following characters, the humerus of Beagys more closely resembles
Vulture than Gymnagyps: The tear drop shaped scar at the tip
of the pectoral crest (on the palmar surface) is close to the external
edge of the shaft; more proximally the pectoral attachment
narrows to meet the outer edge of the crest at a point slightly
prox. to the level of the distal contour of the bicipital crest;
the bicipital crest is broadly & evenly rounded, the bicipital
surface not sharply delineated, the bicipital furrow broad
& shallow
~~only slightly depressed~~ with very slight ^{depression} evidence of pneumatic
~~immediately below the head~~ showing evidence of slight pneumatic
~~distal termination of the~~
~~on Gymnagyps~~ In Gymnagyps the pectoral attachment ~~is more~~ ^{more abrupt at}
~~more medially~~ is more medial, the proximal narrowing is well
distinct to the distal margin of the bicipital crest. The bicipital
crest is uneven in contour & the distal contour of the bicipital
is distinctly raised above the shaft, the bicipital furrow is ~~slight~~
more evident & there is a marked pneumatic depression at the base
of the head.

Nov. 1, 1971

" " " " " " " " " " " "

[illegible]

Humerus Bregyphs vs. Coragyps Cathartes + Sarcorampus

- ① All seem more curved than Vultur, hence closer to Bregyphs.
- ② Bicapital crest squared off in distal contour in Coragyps + Cathartes round in Sarcorampus (like Vultur also) + Sarcorampus
- ③ Position of head drop tips near edge in Coragyps, inset in Cathartes ^{more as in} meets outer edge
- ④ Depression of bicapital depression slight in Sarcorampus but below head more impressed than in Bregyphs (more as in ~~Coragyps~~) Part below head same as Bregyphs in Cathartes + Vultur.
- ⑤ Capital groove much more excavated anteriorly in Coragyps than in Bregyphs. Sarcorampus open as in Bregyphs but median crest with longer + thicker on internal side
- ⑥ Deep pneumatic depression between ext. condyle + base of ectepicondylar process in Coragyps, less in Cathartes, not at all in Sarcorampus (slight in Vultur)
- ⑦ Ectepicondylar process broad with slight curvature in Sarcorampus pale (more curved in Vultur + Bregyphs) high + slender in Coragyps but not much curved ~~less~~ less clearly defined in Cathartes than in Coragyps (in this respect like Bregyphs, but more slender).
- ⑧ Pneumatic depression above int. condyle indicates attach. ant. lig. in Cathartes, Coragyps + Sarcorampus (except that in the latter, it is more an orifice than a depression)

Humeri of Bregyphs

Left B8002 (complete except distal end)	R dist B4847 illus
B3246 (incomplete)	R " B7737
Rt B7247 lacks prox. end	R " B5956
R B7739 prox	R " B2034 (broken ext.)
L B6318 prox	Left B7730 complete
L B2083 prox	(see drawing)
R B5329 prox illus	
R B4954 prox	
R B1583 prox (deltoid broken)	
L B5917 prox (" " also)	
L B2156 prox (" " also)	
	prox 3/4 no contour at end except

Brachyops humerus add B7730 complete left Sept. 1971

A General

- ① Curvature of shaft as in *Gymnocypris*; venter straighter.

B Proximally - Palmar surface

- ② Bicipital crest broadly and evenly rounded; bicipital surface not sharply delineated distally.
- ③ Tear-drop shaped distal-most attachment of pectoralis major muscle very close to external edge of shaft; more proximally the medial border of the attachment meets the outer edge of the deltoid crest at a point slightly proximal to the level of the distal contour of the bicipital crest.
- ④ Bicipital furrow broad and only slightly depressed; very slight depression immediately below head showing slight pneumatization.

Proximal - Antecubital surface

- ⑤ Medial edge of median crest comparatively straight.
- ⑥ Capital groove ^{well depressed} broad as it ^{well depressed} passes into the shaft.

C Distally

- ⑦ Deep ^{pneumatic} depression between external condyle and base of ectepicondylar process, undercutting the sharply defined edge of the condyle.
- ⑧ Ectepicondylar process, observed in external view, broad with only slight curvature.
- ⑨ Deep pneumatic depression above internal condyle and undercutting attachment of anterior ligament.

Complete ^{Left} B8002 T ^{R. dist} 7737+7739 and ^{Left} B7730

Prox ^R B5329 ^R B1583 ^{deltoid} ^{process} Dist. ^R B5954, ^R B4847 +

L62083, L B5917

Gymnocypris prox B6318

Modern *Gymnocypris* 1150, 269, 141 complete
LAEM 3711052 prox

Vulturnus 1734, 218 complete
LAEM
VCCA

Plus others not
brought home
check these #s

Sept 4, 1971
{ R dist B7247 (3/4)
R " B2034 (broken ext)
L prox B6318
R " B4954
L " B2156 Oct 31, 1971

Brachyops compared to Gymnagops & Vultur (graptus)

See characters of Brachyops by number on separate sheet

B Prox-palmar

② Shape, breadth and distal delimitation of bicipital crest & surface in Vultur is similar to Brachyops. In Gymnagops the crest is more unevenly contoured (less broad & round) and the distal contour of the bicipital surface is distinctly raised above the shaft.

③ The ~~for~~ attachment of the pectoralis major muscle is nearer to Brachyops in Vultur than in ^{Gymnagops}. Distal tip is at ^{external} edge of shaft in Vultur, ^{at} ~~more~~ ^{distal} median in Gymnagops. The merging of median contour of the attachment with the edge of the shaft is at or slightly proximal to distal edge of bicipital crest, ^{where} but well distal to the level of the bicipital crest in Gymnagops. Also in Gymnagops the median edge of the attachment sweeps distally more abruptly than in the other two genera.

3a In an ocular aspect the crest is ^{distinctly} more ^{heavily} bordered with greater depression median to the border than in ^{other} Gymnagops or Vultur.

④ The bicipital furrow & slight pneumaticity below the head on palmar side is similar to Vultur. The furrow is slightly more evident in Gymnagops & there is a marked small pneumatic depression at the base of the head.

⑤ The medial edge of the median crest is more rounded & curved in Gymnagops & Vultur than in Brachyops.

⑥ The depression of the capital groove is similar in Gymnagops (to Brachyops) but the groove is more constricted at its junction with the shaft.

over for distal end

C Distal end

- ⑦ One specimen of Vultur (1734) has ^athe deep undercut of the ext. condyle the less so than in Brachyops, both Vultur specimens have sharply defined edge of ext condyle. One specimen of Gymnomyza has tendency to pneumaticity in area bet condyle & ectepicondylar process but the condyle is not completely undercut & the border is not clearly & sharply marked. The other two Gymnomyza specimens are not undercut at all.
- ⑧ Gymnomyza has the deep pneumatic depression above the internal condyle, undercutting the attachment of the ant. ligament (as in Brachyops). The depression is much less marked & no undercutting in Vultur.
- ⑨ The ectepicondylar process is somewhat similar to Brachyops in Gymnomyza but the process is slightly narrower. In Vultur the process is narrower & the proximal tip curves markedly anterior.

$$\begin{array}{r} 12 \\ 04 \\ 24 \\ \hline 62 \\ 512422(5 \\ 000 \\ \hline 192.7 \end{array}$$

$$\begin{array}{r} 22 \\ 96 \\ \hline 192 \\ 451 \end{array}$$

HUMERUS

question whether this arrangement
May 20, 1972 to be the
man

March 14th
3

Material available: Four complete, B3246*, B7730, B7737 + B7749 (proximal and distal ends of the same bone), B8002; one lacking proximal tip B7247; seven proximal ends, B1583, B2083, B2156, B4954, B5329 (illus), B5917, B6318; three distal ends, B2034, B4847 (illus), B5956.

Description: At the proximal end the bicipital crest is broadly and evenly rounded, ~~the bicipital surface not sharply delineated~~ ^{raised distal} distally; the bicipital furrow is broad and shallow with a small, slightly pneumatic depression immediately below the head; ~~xxxxxxx~~ ^{the scar at the distal tip of} ~~xxxxxx~~ the pectoral crest is heavily bordered, and medially depressed, ^{on the anterior surface} and ^{the scar} at its distal tip, ~~xxxxxx~~ is close to the external edge of the shaft; ^{anteriorly the bordering the crest is heavy followed medially by depression} the medial edge of the median crest is comparatively straight; and the capital groove well depressed and broad as it opens onto the shaft. In Gymnogyps the bicipital crest is more unevenly contoured (less broad and round) and the distal contour of the bicipital surface is distinctly raised above the shaft; the bicipital furrow is slightly more depressed and there is a marked pneumatic depression at the base of the head; ^{and anteriorly the} the pectoral crest is less heavily bordered and less depressed, ^{of the pectoral crest} and the scar at its distal tip is inset medially from the external edge of the shaft; the medial edge of the median crest is rounded; the depression of the capital groove is similar in degree to the condition in Breagyps but the groove is more constricted at its junction with the shaft. ^{resembles Breagyps in} ~~xxxxVultur~~ the characters of the bicipital crest, bicipital surface and bicipital furrow, ~~xxx~~ and also in the position of the scar at the distal tip of the pectoral crest. ^{anteriorly} The pectoral crest is, however, less heavily bordered and depressed and the median crest is more rounded than in Breagyps.

absence of a depression below the head

Distally, there is a deep pneumatic depression between the external condyle and the base of the ectepicondylar process undercutting the sharply defined edge of the condyle; there is also a deep pneumatic depression above the internal condyle which undercuts the attachment of the anterior ligament; observed in external view, the ectepicondylar process is broad with only slight curvature. Although one specimen of *Gymnogyps* shows a tendency to pneumaticity in the area between the external condyle and the ectepicondylar prominence, the condyle is not completely undercut and the border is not clearly and sharply marked and the other two *Gymnogyps* specimens show no undercutting; on the internal side *Gymnogyps* has a deep pneumatic depression above the internal condyle as in *Breagyps*; the ectepicondylar process had the slight curvature found in *Breagyps* but the process is narrower. In *Vultur*, the external condyle has a sharply defined edge but there is less undercutting than in *Breagyps* and there is no undercutting of the internal condyle and only a slight depression above it; the ectepicondylar process is narrow and the proximal tip curves markedly anteriorly.

HUMERUS

March 13, 1973

Material available: five nearly complete B3246*, B8002, B5329+ B4847 (illus) (proximal and distal ends of the same bone) ~~and B7730 and~~ B7739+B7737 (also proximal and distal ends of one bone); five proximal ends B1583, B2083, B2156, B4954, B5917; three distal ends B2034, B5956 and B7247.

Description: Anconally, deltoid crest markedly depressed except for distinct, heavy bordering rim. Palmad, pectoral attachment gradually broadening medially from a point proximal to level of distal border of bicipital crest, and distal tip of attachment close to external edge of shaft. Bicipital crest relatively short proximodistally but broad and evenly rounded laterally, protruding noticeably beyond internal tuberosity; Distally, ectepicondylar prominence (lateral view) convex in palmad contour, sharply concave in anconal contour; deep pneumatic fossae adjacent to condyles undercut base of external condyle and ectepicondylar process and (on internal side) the attachment of the anterior ligament.

The depression and bordering rim of the deltoid crest are not duplicated in the humerus of either of the other condors. The surface for the pectoral muscle is similar in shape and position of the distal tip in Vultur, but the widening of the attachment is slightly more distal in position; in Gymnogyps the attachment widens abruptly, the tip is ^{more} ~~mediad~~ ^{more} than in Vultur or Breagyps. The bicipital crest is less prominently developed laterally in both the other condors; in Vultur it is rounded, but longer than in Breagyps; in Gymnogyps it is short, but straighter in contour. The contours of the ectepicondylar prominence are similar in Vultur, but the proximal tip protrudes laterally; the anconal contour is straight in Gymnogyps. The area around the condyles is not markedly pneumatic in Vultur; in Gymnogyps the internal pneumatic fossa is marked, the external is variable in occurrence. *Shaft straighter in Vultur*

Vultur somewhat

Coragyps harrisi

More acute caputal shaft indg

more abruptly flange postnasal fossa

wider deltoid flange

More pneumatic caputal groove

Large pneumatic opening distally
espec. in brach. int. pinn.

Large ^{pneumatic} depression below head (palmed)

Caltra also pneumatic caputal groove
but not below head palmed

(pneumaticity of condyles about as in B tho
V even less distally)

(Radius attached here to (last page) July 30, 1972

ULNA

Material available: ^{eleven} ~~nine~~ proximal ends B1859, B1910, B3838, ~~B4458~~ ^{B4458}, B4630, B6912, B6925, B7248, B8310; ^{K3253} ~~seven~~ ^{seven} five distal ends ^{B392} ~~B3453~~ ^{B1465}, B5891, B6914, B7503, B7715. ^{illus} ~~illus~~

Description; Although none of the specimens is well preserved, two characters seemingly distinguish the ulna of Breagyps from those of Gymnogyps and Vultur. Proximally a pronounced raised area separates the bicipital impression from the external cotyla and the impression is deeply depressed below this area and studded with pneumatic orifices; in both Gymnogyps and Vultur the bicipital impression is only moderately depressed and, lacking a heavy proximal border, blends gradually up to the external cotyla. Distally, the external trochlea in Breagyps is broad (laterally) but short proximo-distally; in both Gymnogyps and Vultur this trochlea is narrower, and in Gymnogyps it is also of greater proximo-distal extent.

OK March 13, 1973

netter

(Radius attached last page)

ULNA

Material available: nine proximal ends, B1859, B1910, B3838, B4221, B4630, B6912, B6925, B7248, B8310; five distal ends, B3553, B5891, B6914, B7503, B7715. (in mt, K3353 prox r B4458 prox; B592 dist B1645 dist)

Description: None of the specimens of this element is well preserved. However, two characters seemingly distinguish the ulna of Bregyps from that of Gymnogyps and Vultur: proximally a pronounced raised area separates the bicipital impression from the external cotyla and the impression is deeply depressed below this area and studded with pneumatic orifices; at the distal end the external trochlea appears short (proximo-distally) and broad. In both Gymnogyps and Vultur the bicipital impression is only moderately depressed and, lacking a heavy proximal border, blends gradually up to the external cotyla. Distally, the external trochlea is narrower in both Gymnogyps and Vultur, and in Gymnogyps it is of greater proximo-distal extent.

Bi. prox	Re. gym	Δ shu
B4630 (29.1)	Bi 141	q. call
	30.2	28.9-31.1-32.7
B8310 30.8		q. amplus
B4221 30.1		32.2-34.3-36.7

Radius
dir B7061 R^{1/2}
not B6782 R^{3/4}

Brachypteryx ulna

ulnae in mt
B1665
K3353 prox
B592 dist
B4458 prox

Sept 1971

NO ILLUSTR.

Material available: Proximal ends (left) B8310,
B6925, B1910, B1859, B6912; (right) B7245, B4630,
B3838, B4221; distal ends (left) B7503, B6914, B3453;
(right) B5891, B7715

Characters: None of the specimens of ulna is well preserved. However, the following distinctions from the ulna of *Gymnogyphus* & *Vultur* are apparent:

- ① At the proximal end, a pronounced raised area separates the bicipital impression from the external condyle and the impression is deeply depressed below. This area is studded with pneumatic orifices.
- ② At the distal end the external falcia appears short (proximo-distally) and broad.

Comparisons: In both *Gymnogyphus* & *Vultur*,¹ the bicipital impression is only moderately depressed and, lacking a heavy proximal border, blends gradually up to the external condyle*. Distally the external falcia is narrower in both *Gymnogyphus* & *Vultur*,** and in *Gymnogyphus* it is of greater proximo-distal extent.

* Situation is more as in *Coragyps* & *Sarcoramphus* though in these it tends to be more pneumatic.

** Ext falcia is also narrower in *Cathartes*, *Coragyps* & *Sarcoramphus* and tends to be more pneumatically set off from shaft medially in *Coragyps*, *Sarcoramphus* & *Vultur* (*Cathartes*, however, has the falcia closely adherent to the shaft with tip narrowing).

1973

Ulna

Probable # papilla for feather 17-19 B

12 cor

142 Sor.

13 cath

17-19 Salter

16 gum

Coracypis more pneumatic than B palmar (below corac)
 + in smaller area above. basilar imp. Also distally
 around the ~~fast~~ condylar part

Sarcocaulis more deeply flared anterior border of
 basilar impression, more depressed under it

RADIUS

Material available: One distal end B7661, one proximal end B6782 (both same side, but not same bone -- each is more than half the length of the total element).

Description: The distal end flares more abruptly than in either *Gymnogyps* or *Vultur* and the ulnar depression is deeper than in *Gymnogyps* (about equal to that of *Vultur*)

Proximally the capital tuberosity is slightly more prominent than in *Gymnogyps*, more like *Vultur*. The bicipital tuberosity is a clearly bordered oval, more than 21 mm below the articular facet. The tuberosity is higher in *Gymnogyps*; possibly nearer *Vultur* though shape seems less clear in *Vultur*.

The smaller vultures are quite different

prox B6782 dist through bicip tub. 21.9 br. facet 13.7

		18.5	13.9
G. 1050		19.5	13.3
269		17.7	13.5
141		23.5	15.5
V 1734		17.0	12.6
218			

CARPOMETACARPUS

Jan 16, 1973

Material available: eight complete right, B1755, B2168, B2667*, B3271, B3625, B5331, B6712, J9402 (illus); eight complete left, B1975, B2181*, B2632, B3154, B4160, B4375, B6395, B7608.

Description: The proximal symphysis is short and deeply channelled internally, and the junction of the process of metacarpal 1 with the carpal area is also a deep groove perforated with foramina; neither Gymnogyps nor Vultur ^{californicus is} ~~are~~ as deeply depressed neither of these areas, but Vultur resembles Breagyps in the shortness of the symphysis, ^{in g. symphysis is longer} The extensor attachment on the anterior tip of the process of metacarpal 1 is long and narrow and nearly vertical in position as in Vultur; in Gymnogyps the tip of the process of M 1 is more bulbous and the extensor attachment is broad and markedly diagonal in position. The internal border of the internal trochlear crest (viewed posteriorly) is abruptly narrowed distally in Breagyps, whereas in both Gymnogyps and Vultur this area is evenly rounded. Distally, the tuberosity of metacarpal 2 in Breagyps is short, but prominent, with a depressed area ^{adjacent} on the anterior face of the shaft; ^{heavily bordered distally} the tuberosity is longer in both Gymnogyps and Vultur, although Vultur more closely resembles Breagyps in having the depression on the anterior face of the shaft heavily rimmed; the tuberosity is ridgelike in Gymnogyps, and the anterior face of the shaft is not depressed adjacent to the tuberosity, there is, however, a greater depression internal to the tuberosity. The distal symphysis between metacarpals 2 and 3 is short in Breagyps and Gymnogyps, considerably higher in Vultur.

Measurements: See Table

CORPUSCULE
BOND
USA
BERKSHIRE

born a bit

CARPOMETACARPUS

Material available: eight complete right B1755, B2168, B2667*, B3271, B3625, B5331, B6712, J9402 (illus); eight complete left B1075, B2181*, B2632, B3154, B4160, B4375, B6395, B7608.

Description: The proximal symphysis is short and deeply channeled internally, and the ^{2 with 10} junction of the process of metacarpal 1 with the carpal area is also a deep groove, ~~and~~ perforated with foramina; neither Gymnogyps or Vultur are as deeply depressed (in the proximal symphysis or at the junction of M 1 and the carpal area) ^{in either of these areas} ~~but~~ ^{but} Vultur, [however], resembles Breagyps in the shortness of the symphysis. The extensor attachment on the anterior tip of the process of metacarpal 1 is long and narrow and nearly vertical in position as in Vultur; in Gymnogyps the tip of the process of M 1 is more bulbous and the extensor attachment is broad and ~~worked~~ diagonal in position. The internal border of the internal trochlear crest (viewed posteriorly) is abruptly narrowed distally in Breagyps, whereas in both Gymnogyps and Vultur, this area is evenly rounded. Distally, the tuberosity of metacarpal 2 ^{in Breagyps} is short, but prominent, with ~~a~~ heavy distal and medial borders rimming a depressed area on the anterior face of the shaft; the tuberosity is longer in both Gymnogyps and Vultur, though Vultur more closely resembles Breagyps in having [the heavy distal and medial borders and] the depression on the anterior face of the shaft; ^{heavily rimmed} the tuberosity is ridgelike in Gymnogyps the borders not heavily rimmed nor is the anterior face of shaft depressed adjacent to the tuberosity, there is, however a greater depression internal to the tuberosity. The distal symphysis between metacarpals 2 and 3 is short in Breagyps and Gymnogyps, considerably higher in Vultur.

Measurements: length externally Breagyps 134-146, G. calif. (only 2 specimens) 136-136.4, V. gryphus 136.1-143.5; depth of proximal end through process of M 1 and internal trochlea B. clarki 31.6-34.9, G. calif. 34.8-35.0, V. gryphus 35.4-38.8

Brachyops carolinianus

May 31, 1972

	Length	max depth ext.	ht max mt	with pear depth	in length m. 14 yr	amplius length max synth.
B 4375	141.2	32.0	14.5	34.5	20.9	29.1
✓ B 6712	—	32.6	14.9	34.6	21.6	30.8
✓ B 3271	134.5	31.7	14.2	34.9	20.3	28.2
✓ B 4160	—	31.0	14.7	34.7	20.7	28.8
B 2168	139.9	32.4	13.6	33.9	20.5	30.9
B 3646	145.2	31.4	13.1	36.3	19.8	34.5
B 2120	141.6	34.2	12.5	36.9	19.4	35.0
B 4473	137.7	35.9	13.2	38.6	20.7	32.8
B 6734	138.5	33.8	13.5	36.3	19.8	32.5
B 5581	143.0	34.6	13.3	37.8	21.4	35.0
B 3646	142.8	34.5	13.5	37.2	21.4	34.6
B 7146	146.8	36.6	15.1	—	22.0	37.2

Brachyops

q. amplius

CARPOMETACARPUS

March 15, 1972

Material available: Eight complete right, B1755, B2168, B2667*, B3271, B3625, B5331, B6712, J9402 (illus); eight complete left B1075, B2181*, B2632, B3154, B4160, B4375, ^{B6395}/B7608.

Description: Proximal symphysis short and deeply channeled internally; internal edge of ~~M2~~³ immediately below symphysis narrow and bladeliike; junction of process of M1 with carpal area a deep groove perforated with foramina; extensor attachment on anterior tip of process of M1 long and narrow and nearly vertical in position; internal border of internal trochlear crest (viewed posteriorly) abruptly narrowed distally; at distal end, tuberosity of M2 short but prominent with heavy distal and medial borders rimming a depressed area on anterior face of shaft.

In Gymnogyps the proximal symphysis is longer and less deeply depressed, the internal edge of M3 is rounded, the junction of M1 and carpal area less depressed; the extensor attachment on the tip of the process of M1 is more bulbous, the extensor attachment broad and markedly diagonal in position; the internal border of the internal trochlear crest is evenly rounded; distally the tuberosity of M2 is long and ridgelike, ~~not prominent, and the internal~~ ^{not prominent, and the internal} border is not heavily rimmed, nor is the anterior face of the distal end deeply depressed adjacent to the tuberosity, but there is greater depression internal to the tuberosity.

In ~~Breagyps~~ Vultur the proximal symphysis is short as in the junction of M1 and carpal region, also is less depressed; Breagyps but lacks the deep channel; the internal edge of M3 is bladeliike, the internal margin of the internal trochlear crest is evenly rounded; distally the tuberosity of M2 is longer than in Breagyps but has the heavy distal and medial borders and the deep depression on the anterior face of the shaft adjacent to the tuberosity. But the symphysis between M2 & M3 is higher than in either Breagyps or Gymnogyps.

whadit R
B37715 subdum

Carfometacarpus

R dist B3149

R B3271

Oct. 19, 1971 See
March 1972
reverts

Material available: Eight right, B2667*, J9402 (illus.)
B1712, B3623, B2168, B4331, B1753, (B2662), and ~~subdum~~
left, B2181*, B7608, B4160, B1035, B4345, B4375, B3154, ~~subdum~~

Description: Most notable distinctions from (both)?

Gymnogyphs and Vultur are found in the ^{shorter} more deeply
depressed, proximal symphysis, ~~more prominent adjacent~~
~~tuberosity of MII~~, and uneven contour of internal trochlear
crest (viewed posteriorly). Further distinctions from Gymnogyphs
are blade like (rather than rounded) internal edge of
of MII immediately distal to the proximal symphysis, and, distally,
shorter but more prominent tuberosity of MII with adjacent
external area deeply depressed. The tuberosity is longer,
more ridge-like and less projecting in Gymnogyphs and the
area internal (not external) thereto is greatly depressed.

~~MI Vultur~~ The tuberosity is intermediate in length ^{prominence of tub.}
~~prominence~~ (compared to Gymnogyphs and Brachyphs) ^{but}
similar to Brachyphs in depression of area adjacent externally ^{both}
~~internal and external adjacent areas depressed~~, Vultur ^{both}
is further distinguished from these two genera in
the very long, flat distal symphysis. Vultur M1 process shorter vertically
than Brachyphs or Gymnogyphs + directed more straight forward

Sarcophagus, Coazyphs & Catantus all have deep prominent tub of
M3 (more ^{on Sarcophagus} straight forward than in Brachyphs)

Catantus is very dif. - longer prox symphysis, long, tub M2, squared
off distal lamina of M3 above dist. end of M2, int crest of trochlear
evenly rounded.

Coazyphs - more attenuated process M1, symphysis ^{23%} flatter as in Gymnogyphs
Tub of MII is long, ~~straight~~ ^{with} ~~ext~~ ^{ext} ~~crest~~ ^{crest} ~~int~~ ^{int} (less int). Very pneumatic
along int. surface of int. crest trochlear crest

Symphysis short &
Broad > ^ Posterior border of M3 at
Distal metacarpal symphysis rounding gradually
(covered externally) to distal end. The symphysis is also short in ~~is angular~~
Gymnazygia but the posterior border of M3 ~~is angular~~
~~at angle above the distal end approaches M2 at~~
~~distinct~~ angle above the distal end. The symphysis is much
longer in Vultur than in either of the other genera

Adl
B2632
LH*

Carpometacarpus - Brachygnathus

Aug. 1971

(5)

- ① ~~Internal face of proximal end rugose~~; junction of M1 with carpal area a deep groove perforated with foramina; proximal metacarpal symphysis and adjacent area of M3 notably depressed, resulting in exaggerating the prominence of the tubercle on M3; antero-internal border of M3 distal to the symphysis thin and blade like [Gymnogyphs with more rounded contours, lacking notable depressions]
- ② Ligamentous attachment of pisiform process with well defined margins; area faces proximo-internally.
[Gymnogyphs with no clear distal margin; area faces more internally]
- ③ Extensor attachment on process of M1 long & narrow and only slightly diagonal in position as viewed anteriorly.
[Gymnogyphs has shorter broader attachment which is more transverse in position]
- ④ Internal trochlear crest narrows distally to produce an uneven ^{somewhat angular} contour which becomes sharply angular.
~~Short ridge descends from distal edge of trochlea onto M3.~~
[Gymnogyphs has evenly rounded internal trochlear crest, and area below is rounded (nondge)]
- ⑤ Distally, the tubercle of MII is short but prominent, with heavy distal & median borders rimming a depressed area on the anterior edge of the shaft.
[Gymnogyphs has longer, ridge-like tubercle, which lacks the heavy internal border and the shaft is not depressed]

141 k
11) 153-23
44
84
72
21
10

Calymenebaccarus contusus (vs. *Vultus*)

Aug. 31, 1971

- ① *Vultus gryllus* less rugose than *Braconyx*, lacks notable depression
- ② Contours of lig. attachment of pisiform process difficult to discern ^{in *Vultus*} owing to adhering ligaments, but the attachment faces more internally & not at all proximally
- ③ extensor attachment ^{in *V. gryllus*} on process of M₁ long & narrow as in *Braconyx*
- ④ Internal trochlear crest more evenly rounded in *Vultus gryllus* than in *Braconyx* and area below crest though raised is less acutely edged.
- ⑤ Tuberosity of M_{II} (distally) longer in *V. gryllus* than in *Braconyx* but heavy distal & median borders are similar as is the depression on the shaft

Pneagyps californiacarpus is *Coragyps*, *Cathartes*,
Saurorampulus & *Vultur*.

- ① Beak less depressed in *Vultur*, closer to *Coragyps* tho M. more pointed in *Coragyps*. *Cathartes* very dissimilar in long, broad prox. sympleysis.
- ② Extensor attachment like *Vultur*.
- ③ The uneven contour (distally) of the internal trochlear crest with short ridge below is most closely simulated in *Coragyps*, but the tip protrudes internally in the latter genus (not so in *Pneagyps*).
- ④ Distal tubercle of MET is closer in *Vultur* than in *Gymnogyps* - has heavy rim but area is more pneumatic. *Cathartes* very much longer tubercle but is heavily rimmed. No as prominent anteriorly as *Coragyps* as in *Coragyps*. Short + moderately prominent (but less than *Coragyps*) in *Saurorampulus* but less heavily bodied + depressed.
- ⑤ Distal sympleysis very high in *Vultur*, quite low (narrow) in *Pneagyps*. Narrow in *Saurorampulus* + *Coragyps*. Squared off in *Cathartes* so dissimilar to all others.
distally

a
 M.I. facet
 X
 6
 sept
 ext

I
 c
 g
 M.I.
 int
 M.I.
 (cont. sept)
 X
 ba

Ratios
 2
 M.I. facet
 Ratios
 ea

	145.8	25.1	32.1	14.5	34.2	21.4	21.9	22.0	23.4	15.0	93.9	36.0	60.8	24.7
N 9402	145.8	25.1	32.1	14.5	34.2	21.4	21.9	22.0	23.4	15.0	93.9	36.0	60.8	24.7
VB 3625	143.7	28.0	31.7	21.7	33.2	14.8	22.4	22.0	23.1	15.6	95.5	35.8	62.6	24.9
-B 2667	142.8	28.4	31.7	22.0	33.5	19.8	19.8	22.2	23.5	13.9	94.6	34.0	58.8	24.8
VB 5339	141.8	28.9	31.7	22.6	34.0	15.9	22.4	22.3	24.0	15.8	93.3	36.2	61.9	25.5
-B 2181	145.1	30.3	31.3	21.9	34.4	21.4	21.1	21.8	24.0	14.9	91.0	35.8	59.7	25.0
-B 3154	138.8	29.3	31.2	22.3	34.2	20.9	21.1	22.4	24.8	15.0	91.3	34.8	60.1	25.0
VB 4375	141.3	29.4	31.7	21.4	34.5	20.9	21.1	22.4	24.4	14.7	91.9	35.1	59.6	24.8
VB 6395	143.5	30.2	31.5		35.0	14.6	21.2	21.0				34.3		
VB 1075	140.4	29.1	31.1		32.6		22.1	20.7						
VB 7608	139.2	29.9	31.7		33.9		20.3	21.4						
VB 2432	141.8	26.4	31.5		34.1	13.8	20.4							
Vanish														
218	136.0	26.6	32.6		35.4	15.6	19.5	24.0	26.0	14.4	91.2	34.8	56.3	25.6
1734	142.5	28.7	34.7		38.9	20.7			25.5	14.4	91.9	34.6	57.0	25.3
gymn	136.6	32.8	32.0	20.6	34.8	19.7	24.0	23.8	25.2	15.0	91.7	36.9	57.7	26.0
R 69	136.1	31.7	32.8		35.1	19.7	23.2	24.4						
141	141.9	33.9	34.7		35.7	21.3	23.9		25.8	14.7	91.0	35.5	57.2	25.8
B 6339														
B 3782	137.7	33.0	33.8		35.6	20.3	24.0	24.5	25.8	14.7	91.0	35.7	57.3	26.7
B 2000	133.5	33.0	33.9	22.1	36.0	20.4	24.7	25.4	26.9	15.2	94.3			
B 7634	138.4	32.0	31.8	20.5	33.3	19.3	22.9	23.0	24.0	13.9	60.7	33.4	52.7	24.1

gymnogyphs so seems
 that measurements are not
 except, probably, prox. symphysis

143.7 107.5 136.2
 141.9 105.5 B 6339
 24.5
 25.0

Aug 1971
 Lister gives lengths in first gymnogyphs up to 148 mm
 M front 139
 M recut 132

OLD

PELVIS

March 13, 1973

Material available: Two fairly complete with synsacrum, B4912* and B1082+B1092 ((anterior and posterior parts of the same specimen); four with incomplete pelvic bones and synsacrum, B1635, B3346, B6859, B7895; one fragment of anterior ilium B6865 (No illus). + frag in int B 5166 *

Description: Owing to incomplete preservation dependable distinguishing characters are limited. Anterior ilia meeting in midline to form long, narrow ridge; posterior iliac crest protruding above acetabulum and ilio-ischiatic orifice; posterior ilio-ischiatic surface deep with iliac and ischiatic borders nearly parallel. Dorsal surface of shield moderately convex in midline; laterally perforated with evenly spaced, fairly large pneumatic openings posteriorly with smaller openings farther forward; acetabulum deeply notched on lower internal margin toward anterior edge.

In Vultur, the anterior ilia ~~meet~~ ^{the two ilia are separated} meet in a heavier ridge and for a shorter distance; in ~~Gymnogyps~~ ^{Sarcophaga} they ~~meet~~ ^{are separated} in midline by ~~spines~~ ^{dorsal spines of} of sacral vertebrae. Posteriorly, the iliac crest protrudes above the acetabulum in ~~Gymnogyps~~ ^{Sarcophaga} as in ~~Breagyps~~ ^{Sarcophaga}; in Vultur, however, ~~it~~ ^{it} ~~recedes~~ ^{recedes} above the ~~edge~~ ^{edge} of the posterior ilia ~~above~~ ^{above} the ~~acetabulum~~ ^{acetabulum} and is thickened above the ilio-ischiatic orifice. In ~~both~~ ^{Sarcophaga} Vultur and ~~Gymnogyps~~ ^{Sarcophaga} the dorsal contour of the ~~posterior ilium~~ ^{posterior ilium} posterior to the acetabulum curves downward ~~thus~~ ^{thus} ~~narrowing~~ ^{narrowing} tapering the ilio-ischiatic surface posteriorly. The area of the shield in ~~Breagyps~~ ^{Sarcophaga} combines the moderately convex midline/with the lateral perforations similar to Gymnogyps. The perforations are fewer and smaller in Vultur, the midline much more convex in Gymnogyps. The deep notch in the acetabulum is not found in either of the other condors.

PELVIS

May 18, 1972

Material available: Two fairly complete with synsacrum, B4912* and B1082-B1092 ((proximal and distal parts of the same spscimen); four with incomplete pelvic bones and synsacrum, B1635, B3346, B6859, B7895; one fragment of anterior ilium, B6865. No illus

Description: Owing to the incomplete preservation of the few pelvic specimens available, dependable distinguishing characters are limited. The anterior iliac area is higher and narrower than in Gymnogyps, and the anterior border of the ilia extends nearly to the anterior end of the first of the three synsacral thoracic vertebrae, whereas in Gymnogyps nearly the entire first synsacral vertebra protrudes beyond the iliac border. Breagyps is closer to Vultur in these characters. Posteriorly, in Breagyps, the dorsal surface of the shield is moderately convex through the center and slightly depressed laterally; in Gymnogyps the center of the shield is narrower and markedly convex, and the sides are abruptly depressed. Again Breagyps is closer to Vultur, although the shield is less perforated in Vultur. Ventrally, the broadest extent of the sacral vertebrae occurs posterior to the acetabulum in Breagyps whereas in Gymnogyps the point of greatest extent coincides with the posterior border of the acetabulum. Within the acetabulum, the notch on the lower median margin seems to be deeper and more distinct in Breagyps than in either Gymnogyps or Vultur.

Measurements: Length of synsacrum, 141.4-144.6 mm. (Gymnogyps californianus 134.3 - 152.2 mm.; Vultur gryphus 139.6-163.2mm.); distance from anterior edge of ilia to posterior end of synsacrum 137.1-142.5 mm (G. californianus 123.8-138.1mm., V. gryphus 134.5-149.1 mm.); least breadth across ilia 40.6-41.6 (G. californianus 39.9-45.2 mm.; V. gryphus 45.8-47.6 mm).

Description: The anterior iliac area is higher and narrower than in *Gymnogyps*; ~~and~~ the anterior border of the ilia extends nearly to the anterior end of the first of the three synsacral thoracic vertebrae whereas in *Gymnogyps* nearly the entire first synsacral vertebra protrudes beyond the iliac border. *Breagyps* is closer to *Vultur* in these characters. The iliac crest is high as in *Gymnogyps*, but the right and left sides are more closely appressed;

Owing to the poor preservation of the few pelvic specimens, ~~distinguishing characters~~ only a few ^{distinguishing} characters can be relied upon ~~to distinguish~~ for:

Description: The anterior border of ~~the~~^{clear} ~~the~~^{the} extends (almost to the anterior
1st of 3 synsacral thoracic vertebrae
~~border of zygapophyses of the antero-most synsacral thoracic vertebra;~~

dorsal surface of posterior part of synsacrum moderately convex in center, with slight lateral depressions; ilia of ant. cl. and slightly depressed laterally; ^{pelvis} narrow through lumbar and thoracic area; transverse processes of thoracic vertebrae ^{are} stout with only slight pneumaticity; acetabulum ^{the} deeply notched on the lower median margin slightly anterior to center; viewed ventrally, the broadest extent of the sacral vertebrae occurs posterior to the acetabulum. Anterior iliac area high & narrow; iliac crest closely appressed to 20-30 mm ant. to acetab.

~~Compare not~~ In *Gymnogyps* ~~the~~ nearly the entire first synsacral
thoracic vertebra protrudes anterior to the ilia; the condition in
Vultur is between that of *Breagyps* and *Gymnogyps*; dorsal surface of
posterior part of synsacrum decidedly convex in *Gymnogyps*, abruptly
depressed on either side

Comparisons: *Gymnogyps* differs from *Breagyps* in nearly the entire
the ant. border of the ilium is well back of the ant. end of the synsacrum;
first synsacral thoracic vertebra protrudes anterior to the ilia, the
central area of the dorsal surface of the synsacrum is ^{narrow} markedly
convex ^{and} with ^{depressed} abrupt lateral depressions; the thoracic vertebrae are
more pneumatic, viewed ventrally the broadest extent of the sacral vertebra
coincides with the posterior border of the acetabulum. Vultur is closer
to *Breagyps* in most characters but ^{the} Thoracic vertebrae are more pneumatic,
~~and~~ the shield is less perforated, ^{the ilia} ~~a fine~~ ^{a broader} ridge ^{where they}
~~are to be met~~ are joined.

4450KLB	34.9	42.3	43.1
		57.3	48.1

PELVIS

Two nearly complete Nos. B4912 and B1082

Material available: ~~Two nearly complete~~ ~~specimens~~

and five fragmentary (B5165, B4912 in mounted specimen)

B1635 mid portion

Description: (specimens have ant. border)

Anterior border of ilium closer to anterior end of synsacrum than in *Gymnogyps*, ~~more nearly resembling Vultur~~; the

border is still farther anterior in ²*Coragyps* and ¹*Cathartes* and the

two available specimens of *Sarcoramphus* vary in this respect

(one is like *Breagyps*, the other still ^{like *Gymnogyps*} farther anterior. 2.

Transverse processes of synsacral thoracic vertebrae are less pneumatic than in either *Gymnogyps* or *Vultur* and closer in this respect to *Coragyps*. 3. The obturator foramen is longer than in *Gymnogyps*; closer to *Vulture* but a bit longer even than in this genus.

5. ^{Dorsal surface of synsacrum} Shield only slightly convex medially, unlike *Gymnogyps* in which the narrow central strip is decidedly convex; in *Vultur*, ^{Cathartes & Coragyps wider flat} also the

area is well rounded but the convex portion is broader than in *Gymnogyps*; the fossil is closer to ^{Vultur} *Sarcoramphus*, the central part of the shield in *Coragyps* and *Cathartes* is flattened.

The R & L ilia are closely appressed along the

median dorsal ridge - tend to be separated in *Gymnogyps* *Vultur* near a bit flatter across ridge (high up side). (close to *Gymnogyps* in this) *Coragyps* & *Sarcoramphus* much flatter & wider & ilia wider apart. *Cathartes* very broad & wide apart

Ilium deep dorso ventrally, less.

B1092 L side 1/2 post with acetab & post ilium

B1635 Complete sacrum & mid part pelvis

B3346 Sacrum & ant. pelvis (no acetabulas)

B5165 in mt?

- B1895 sacrum & frag of pelvis

- B6859, L post part of pelvis & sacrum

B4912 mt.

B1895 comp. sac. & some pelvis

B6859 post. same specimen 81092 7

Shield slightly perforated

Shield of sac. more so recent

Breagys mount

skull K3158
 lower jaw Old #1347 (2 frags.)
 furcula B8308, B8309
 coracoids B1495, H3837
 sternum B1428
 pelvis B5165 and B4912 (2 pieces)
 humerus B3246 and two frags. of unknown #'s
 (B5530 was to have been used but was replaced)
 ulna (pc) } ^{prox}
 K3353
 B1465, B593, B445-8
 dist A dist prox
 carp., B2667, B2181
~~Scaf.~~ B4862, B7558
 femora B3379, B3576
 tibia B7026, B7746
 tarsi B3111, B5573

Pelvis

Of the 3 Thoracic vertebrae incorporated in the sacrum

The ilium extends ant. edge of the ilium extends almost to the anterior border of the zygopophyses of the anterior

of the 3 Thoracic vertebrae incorporated in the sacrum In Gymnophis ~~has zygopophyses~~ practically the anterior thoracic processes beyond the ilium is bet. Breagphs & Gymnophis in this char. possible Vultur has less vertebrae particularly but, possible closer to Breagphs.

		B		ant edge ilium to post. sacral vert level with pat edge ischium	
B1082	42.8	142.5	length	pelvis	force
B1082	146.6	137.1	length	but edge ilium to post. sac. vert.	
B3346	141.4	134.5	"	"	"
B1082	139.6	149.1	"	"	"
B1082	163.2	123.8	"	"	"
B1082	138.0	130.2	"	"	"
B1082	150.1	125.0	"	"	"
B1082	137.3	138.1	"	"	"
B1082	152.2	128.9	"	"	"
B1082	145.1	127.2	"	"	"
B1082	135.9	142.6	"	"	"
B1082	142.6	40.6	"	"	"
B1082	41.6	44.0	"	"	"
B1082	41.3	44.0	"	"	"
B1082	44.5	44.5	"	"	"
B1082	43.7	45.0	"	"	"
B1082	47.2	47.2	"	"	"
B1082	39.9	43.1	"	"	"
B1082	47.6	43.1	"	"	"
B1082	45.8	43.1	"	"	"

Ratio BA

B1082	99.70	Breagphs
B3346	97.4	
575	86.8	Gym.
144	93	
371	90.7	
144	87.7	
31	89.5 (or 92.4)	
302	94.0	
218	96.3	
1734	91.5	

Posterior symphysis directly central area moderately convex

Gymnophis with very slight lateral depressions. Vultur similar but ridges form more a ridge as they come together. Gymnophis with markedly convex center abruptly depressed on both sides, also the ridges form ridges - they meet & are widely apart to greater ant. extent

April, 1972

Pelvis

2 nearly complete

Material available: B4912* and B1082;

B1092 (left post pelvis)

incomplete, B1092 (belongs with 1082 left part ilium) B1635 sacrum
and mid sect. of ilium (includes acetab.) B3346 (sacrum and anterior ilia), B5165 (int
B7895 (sacrum & frag of pelvis), B6859 (post sacrum + left middle
ilium + ischium)

Material available

4.4.72

✓ nr. complete B4912 in mt.

✓ nr. complete B1082 + 1092 (the left acetab. + part of post il. + ischium)

— R ilium (med) B6855 R frag. ant. ilium + acetab. + styloidischium for.

✓ centrum + B7895 R ant. edge, acet.

✓ centrum + B1635 R mid part of ant. ilium + acetab.

✓ centrum + B3346 R + left ant. margin of ilia (no acetab.)

— incomple. centrum + B6859 L mid part of ant. ilium with acetab.

centered from catalog B5165 frag. of pelvis (not found - is it in mt?)

→ The acetabulum is deeply notched on the ^{lower} median margin slightly out to center. Viewed ventrally the broadest extent of the sacral vertebrae occurs posterior to the acetab. whereas in *Gymnagys* it coincides with the post border of the acetab.

The *Braegys* pelvis is narrower than the ilia of the lumbar area, thoracic, transverse processes of Thoracic ~~area~~ are ~~stronger~~ (less pneumatic than in *Gymnagys* or *Vultur*). Dorsally the ^{center of the sacral area} ~~synsacrum~~ is broadly rounded in contrast to a narrower, more prominently raised central area in *Gymnagys* (also flatter than *Gymnagys* *Vultur* class. In *Gymnagys* the synsacrum is notably depressed on both sides of the center with sacral area. Centrum in lumbar + thoracic area appearing broader than in *G.* (more rounded or *Vultur*).

Alaska

Pelvis

B4912, B1082

B5165^{mt}, B4912^{mt} 2 pcs

Material available. — Several specimens, two of which are ~~to~~ nearly complete, and one is only a fragment of ~~the pelvis bone~~ ^{isolation}, the other four ~~are~~ synsacra with portions of pelvic ^{element} attached.

Characters. — (1) Anterior border of ilium closer to anterior end of synsacrum than in *Gymnogyphs*? closer to Ulnus in this; ~~all further posterior~~ ^{all anterior} than *Coragyps* & *Cathartes*; The two avail. spec. of *Sarcoramphus* vary in this respect, one being approx. like the first, the other still further anterior. (2) Transverse processes of synsacral thoracic vertebrae less pneumatic than *Gymn.* or Ulnus, closer to *Coragyps*. (3) Obturator foramen larger than *Gymnogyphs*; closer to Ulnus than a bit larger than this genus as well. (4) Shield only slightly convex medially, unlike *Gymnogyphs* in which various central strip is decidedly convex; Ulnus also well-rounded ^{convex} ^{extension} than *Gymn.*; fossil closer to *Sarcoramphus*; the central part of the shield in *Coragyps* & *Cathartes* is flattened.

Characters of Pelvis in Dalmians

Shape of ilio-ischiatric foramen

doesn't hold

Number of synsacral vertebrae in
any series

Shape of ilium anteriorly

" "

Size of obturator foramen

OK

Closeness of ilium to ant. end of synsacrum

Holds approx. ly

appears OK

Shape of bulge of synsac. dorsally

" OK

Anterior end of pubis & pectineal process

Pneumatization of trans. process

OK
But is indescribable

Belvis - clarkii

	gr. bu. q dim. (pat.)	br. sym. sac at lat canted	leaf br. dim. cut.	pot for.	
B 4412	80.0?	30.0?	43.0?	19.8	21.3
B 1082	78.0	32.7	40.6	19.6	29.9
V 218	78.2	30.5	46.4	19.0 (18.4)	30.6
G 302	83.8	29.1	44.6	17.3	26.4
G 31 can.	80.4	27.1	42.5	15.8	27.5
G 371	86.0	29.7	44.2	16.8	27.5
G 31 mo	84.3	26.8	45.3	16.5	29.0
G 139	81.4	24.8	45.3	16.0	

Post h. the diac crest protrudes above the anti-holochants
as in most other catenulids except ^{to Sai.} V. In V the
crest is not developed & does not overhang ~~the~~

^{del. ischialia}
~~Obolus~~ foramen large & round,
oval in Co. & Cath & Sai, Round in G & V
but not as smoothly rounded as B.

Scapula & Sai

Gen. shape like G. But acrom. proceeds from
shaft more abruptly & does not protrude as markedly
antero-ventrad ^{as in G}. These distinctions are even more marked
in contrast to V. which takes off even less abruptly than G

& is more protruded ant-vent. Sai is closer to Brea except
acrom. take off is less abrupt, but ant. prof. is about same as B. ^{How much larger acromion is than}
Corapys is dif. in that acromion projects laterally ^{more}
& is apparently also shorter ^{definitely}

Cath is dif. in that the glenoid facet protrudes
at rt $\angle$ to shaft rather than rounding in as in the
others (B, G, V) the glenoid facet area is slightly projected
also in Co. but worse than Cath.

Pebbles

In Brachyops the ant. ilia are appressed
in the midline ^{for a distance} for at least 40 mm starting 16-20 mm
ant to the acetabulum. This condition is closest to Vulture
4 post. sac. vert. most ant. one is at ant. edge of ilia in last 6 vert.
The meeting of the ilia is much farther forward
in Symnorys & of less duration & less closely appressed

Rate of the dorsal pectorals are the same (gymna)
(greater than Vulture) but center is more convex in Symn.

Corys ant. is less appressed & short than only.
Partly flat center & large perforations (larger than Brachyops)
4-5 post. sac. vert.

Saccorhamphus partly ilia don't meet. Partly
less convex center, perforations comparable to Brachyops
6 post. sac. vert.

Vulture ilia meet ant. at about same place
as Brachyops but midline is broader, less
ridge like

Cranium cond. like in narrow supra
occipital process & well de'd. opisthonic process
vertical edge of supra. narrow above sharp sides
& short flared vertical less angled center of supra.
posterior). than in either S. or V.

Cor. Cath & Sacco. have more rounded contour
of supra. the processes not flared out from the upper
part. Opisthonic are very little de'd. in Cor & Cath
slightly better in Sacco.
foramen magnum high in Brachyops, supra oc
recid in above; not fused with others

Pneumys B1082
 a b
 junction of ant
 dia ant
 to acule 16.2mm - 89.3
 B6859
 23.0 - incomplete

least to across ant dia
 40.9 - 42.3

Pelvis
V. gypheus 218
 a b
 15.5 - 85.4
 C 46.1
V. gypheus
 173y
 a b
 20.5 - 91.8
 C 49.7

Gymnys B445C
 a b
 38.5 90.8
 C 57.6
 B8030
 37.3 - 82.5
 B616
 49.6 - 85.8

In *Sarorunglun* kapa the ant. illidorsum unit
 they approach (quite ant/ls) Postnasal area, perforated but less than *Cor. or latr.*
 center slightly convex.

In *Cathartes aura* the ant. dia are widely
 separated, Postnasal area broadly perforated dorsally, flat center

In *Coragyps* the ant. dia ~~are~~ practically
 meet at one point but then diverge again, Highly perforated
 facial area dorsally (flatly) flat center

716 27.2 - 50.3

228 24.3 - 49.6

No. of transverse processes ventral

	ant	post
<i>Pneumys</i>	6	4
<i>Gymnys</i>		
<i>Coragyps</i>	7 + spino	5
<i>Sarco.</i>	5 - 6	6
<i>Cath.</i>	5	5 -

Pneumys slightly perforated post. sacral area (dorsally)
 center convex, This is true, also of *Gymnys* but the
 center is more convex in *Gymnys*

Uellus has only small perforations dorsally in
 post sacral area (much less than *Pneumys*)

Murcula

Clavicle tip long + slender in
 G + V. Short + squared off in Sar.
 ant Curve broad also as in condors
~~very~~ more at angle in Cor. + very at angle
 in Cath with tip actually bent down

SWellier at lower edge of tip ext. with premaxilla
 on fur above possibly closest to Sar. but shaped
 tip is much shorter + squarer in Sar.

One of symphyseals appears broader

Order of similarity:

Scapula

clavicles Vultur, Gym. Sar. Cor. Cath

Corac

Scap Sar, Gym, Vultur, Cor. Cath.

Pelvis Vultur, Gym, Sar. Cor. Cath.

Pelvis

April 11, 1973

Median dorsal ridge formed by

Ant. ilia closely appressed in ^{high} narrow dorsal

- ① runs of ant. ilia closely appressed for at least 50 mm.
~~Ridge wider in G.~~
~~ilia more widely separated~~

Ridge wider in V. Two ilia meet for shorter distance
In G ilia converge but in most specimens do not
meet. Where they meet it is for very short distance

- ② Ventral view widest point of ~~synsacral~~ caudal area
of synsacrum posterior to post. rim of acetabulum

~~In V, this is also true, but in 218~~

This is true also in V + *Caragyrus* or *Cathartes* (?) (lighter colored)
But in *S. r. s* this point is at ~~the level of~~ ^{at a} within the
~~post. margin of the acetab.~~ Cath.

- ③ Transverse processes of
Synsacral lumbar vertebrae (viewed ventrally) heavy
and no foramina ventrally, ~~the extent of ilia lateral~~
ilia narrow. Three lumbar vertebrae (V has 3 lumbar
G has 3 + a small last one)

- ④ 3 Synsacral Thoracics ^{with ventrally} non-pneumatic ~~ventrally~~ transverse
processes ^{antmost} protrudes very slightly ant to ilia (less than in V)
~~as in~~ Processes very pneumatic in V + G

G has 3 thoracics attached ant one is ^{partly over ilia} ant to ilia
V has 3 thoracics attached; ant protrudes a little past
the ilia but not as markedly as in G.

Caragyrus has 2 thoracics attached (non-pneumatic) set well
back of ilia

Sarco. has 2 thoracics attached. Antmost is at level of ant
end of ilia (like 3rd one in B).

Cath. similar to *Sarco.* but much more flared ilia &
flatter (ilia withdrawn)

fenestra completely formed externally

D lid ischiatic ~~fenestra~~ fenestra (preserved in one specimen) very large, distinct in int. sin.
78.8 = ht. across post. dia 142.2 length synsacrum 40 = ht. lid ischiatic area
21.5 x 27.5 mm; post. iliac crest overhangs it (obtusator for 19 mm)

V rel. smaller 18.7 x 25.5, iliac crest recedes above it 19.5 x 23. (218) (77.5 across post. dia) 140 mm length synsacrum 34.5 = ht. ilia ischiatic area (218) obtusator for 18.8 mm

G. less distinct, ~~fenestra~~ fenestra 22.2 x 24
Inter sin. protrusion than in V.
but iliac crest overhangs. Obtusator for smaller 16.4
fenestra incompletely formed externally.

Cor. large + iliac overhangs 11.2 x 17.3
obtusator 10.8

Cath complete fenestra ext with overhang

Cor. " " " " "

Sac. " " " " "

✓ tends to be incomp. ext. no "

G. incomp. ext. with overhang

Definite angle bet. dorsal face of post. dia + int. lateral face as in V.

G. + sacro (but less so than G!) dorsal face to the lateral face

Cor. angle even more inclined than B

Cath angle but ~~slants~~ ^{slants} outward (not straight as in V)

Ilia of less extent beyond parapophyses in B than in G.; V. closest. Sac. + Cath wider Cor. intermed but wider than B

FEMUR

Jan 14, 1973

Material available: ^{Ten}Eleven complete (Or nearly complete), B1404, B3358, B3379*, B3576*, B4989, B5580 (illus.), B5693, ^{Gymnogyps}B5873, B6259, B7493, B7803; two lacking proximal end, B2599, B6910; two proximal ends, B2257, B6372; six distal ends, B1437, B1574, B3388, B5950, B6620, B7460; one shaft with partial distal end, B6938.?

Description: The proximal end flares notable from a narrow shaft and the trochanter is decidedly flexed anteriorly. In Gymnogyps the shaft is stouter and more columnar with less flared ends, the trochanter is less anteriorly flexed. Resemblance ^{of Breagyps} is closer to Vultur in these respects, though the shaft is straighter in lateral profile in Vultur, and the trochanteric crest lacks the ^{bordering} pneumaticity found in Breagyps. The attachment of the round ligament on the head is narrower and deeper than in either Gymnogyps or Vultur. The contour of the proximal end, anteriorly, from trochanter to head is smooth y curved as in Vultur; in Gymnogyps there is a slight bulge ^{just above the head} in the contour ^{adjacent to the trochanter} just ^{medial} of the trochanter. ^{cut}

Distally the muscle scar above the fibular condyle is shallowly rugose and tends to face more proximally than posteriorly; in Gymnogyps the scar is greatly depressed and heavily bordered and faces posteriorly; in Vultur the scar is more rugose than in Breagyps but less depressed than in Gymnogyps.

Breagyps is further distinguished from Gymnogyps and Vultur by the position of the intermuscular line on the external side of the shaft. This line curves anteriorly just above the middle of the shaft than swerves outward again at the level of the long muscle scar on the trochanter; in Vultur the line swerves slightly but not as abruptly and in Gymnogyps it proceeds almost directly up the external side of the shaft with no abrupt deviations.

Measurements: Length of femur from internal condyle to iliac facet 129.0-139.4 mm (mean 134.8); G. californianus 126.0-134.6 mm (mean 130.9); Vultur gryphus 138.2-148.4 mm. Maximum breadth of proximal end 36.8-40.5 mm (mean 39.3); G. californianus 33.5-36.4 mm, (mean 35.1); V. gryphus 39.6-42.6 mm. Maximum breadth of distal end 35.5-38.4 mm, (mean 37.6); G. californianus 33.7-36.2 mm (mean 34.8); V. gryphus 38.1-39.5 mm. Least dimension of shaft 14.5-16.3 mm (mean 15.5 mm); G. californianus 15.0-16.8 mm (mean 15.7 mm); V. gryphus 15.7-16.7 mm.

figures checked

REMARKS
USA
BOND
(CORRASABLE)
EATONS
800

FEMUR

May 18, 1972

Material available: Eleven complete (or nearly complete), B1404, B3358, B3379*, B3576*, B4989, B5580 (illus), B5693, B5873, B6259, B7493, B7803; two lacking proximal end B2599, B6910; two proximal ends, B2257, B6372; six distal ends, B1437, B1574, B3388, B5950, B6620, B7460; one shaft with partial distal end, B6938.

Description: The femur of Breagyps is distinguishable from that of Gymnogyps in general conformation, having a narrower shaft and more widely flared proximal end; resemblance is closer to Vultur in these respects but in the latter genus the shaft is straighter in lateral profile. *Note: humeral notes*
Fibular condyle shorter anteroposteriorly than G (similar to V)

Further distinctions from Gymnogyps are as follows: greater anterior flexure of the trochanter, narrower, deeper attachment of the round ligament on the head, smoothly curved contour of the proximal end from trochanter to head (in this area in Gymnogyps there is a slight bulge just medially of the trochanter), large and shallowly rugose muscle scar above the fibular condyle tending to face more proximally than posteriorly (the scar in Gymnogyps is greatly depressed and heavily bordered and faces posteriorly).

In Vultur the trochanter is more anteriorly flexed than in Gymnogyps, but less so than in Breagyps and is further distinguished from the fossil genus in less marked pneumaticity bordering the trochanteric crest. ~~The attachment of the round ligament is broader than in Breagyps~~ The contour of the proximal end from trochanter to head is smooth as in the fossil, but the attachment of the round ligament is broader and the muscle scar above the fibular condyle somewhat more rugose, though less depressed than in Gymnogyps.

A further distinction of Breagyps ~~from Gymnogyps~~ is found in the position of the intermuscular line on the external side of the shaft. In the fossil genus this line curves anteriorly just above the middle of the shaft then swerves abruptly outward again at the level of the long muscle scar on the trochanter. In Gymnogyps

over
B413

3

over

it proceeds almost directly up the external side of the shaft with no abrupt deviations; in Vultur the line swerves slightly but not as abruptly as in Breagyps.

Measurements: Length from internal condyle to iliac facet, ^(8 specimens) 129.0-139.5 mm. ^{mean 134.8} (G. californianus, 126.0 - 134.6 mm. ^(7 specimens); ^{mean 130.9} Vultur gryphus, 138.2 - 148.4 mm.); maximum breadth of proximal end, 36.8-40.5 mm. mean 39.3 (G. calif. 33.5-36.4 mm., mean 35.0; V. gryphus 39.6-42.6 mm.) maximum breadth distal end 35.5 mm.-38.4 mm., mean 37.6 mm. (G. calif. 33.7-36.2 mm., mean 34.8 mm.; V. gryphus 38.1 - 39.5 mm.); least dimension of shaft 14.5-16.3 mm., mean 15.5 mm. (Gymnogyps calif., 15.0 -16.8 mm., mean 15.7 mm.; V. gryphus 15.7-16.7 mm.).

checked

$$\begin{array}{r} 244.8 \\ 34.8 \\ 7 \overline{) 243.8} \\ 21 \\ \hline 33 \\ 28 \\ \hline 58 \end{array}$$

$$\begin{array}{r} 15.7 \\ 7 \overline{) 110.1} \\ 7 \\ \hline 40 \\ 35 \\ \hline 51 \end{array}$$

① Oct. 14, 1971

LB5380
(in sep. drawer)

head/sh
90 doesn't
hold in
front German

condyle less depressed and ~~less~~ ^{more} flexed
 H On Venter the trochanter is more arched, flexed
 than in gymnotype, but less so than in Brachyops,
 and is further distinguished from the fossil in less
 marked pneumatization bordering the trochanteric crest.
~~The placement of the obturator ridge is diagonal as in~~
~~Brachyops but the area internal to the ridge lacks the~~
~~abrupt depression found in Brachyops & gymnotype.~~
 The head equals that of Brachyops in size but the
 attachment of the round ligament is broader. The ^{shape & extent of the} ~~area~~ ^{can}
 above the fibular condyle more nearly resemble the condion
 in gymnotype than in Brachyops.

Post 19
~~Line from trochanter to head~~

Viewed proximally the ~~contour~~ anterior contour of the prox. end (from trochanter to head) is a smooth curve. In gymnops there is a slight bulge adjacent ^(medial) to the trochanter. Vulture is like Bucconidae

~~Lowest intermuscular line ^{runs nearly straight down shaft} above distal end to external side, turns abruptly upward, ^{gives} anterior ~~line~~ to middle of shaft then posterior to level of lig. attach on trochanter whence it turns abruptly to its attach.~~

External intermuscular line forms ^(on myofemur) an elongated S from base of lig. scar on trochanter to distal end (the S is inverted on the left femur)

The external intermuscular line curves ~~medial~~ ^{posterior} just ^{above} the middle of the shaft then curves abruptly outward again at the level of the long muscle scar on the trochanter. In gymnops the intermuscular line proceeds in a nearly straight line ~~to~~ ^{for its} length on the shaft

Sept 1971

Nos. *Bucconia* (vs *Gymnophis* & *Vultur gryphus*)

- ① Femur with slender shaft, proximal end notably flared and distal end moderately so
- ② Trochlea with decided anterior flexure; ~~bordered & undercut by large pneumatic orifices~~
- ③ Posteriorly, obturator ridge diagonal in position (starting proximally towards head); area internal to the ridge abruptly depressed.
- ④ Rotular groove narrow?
- ⑤ Proximal ~~muscle scar~~ ^{loss of rugose} above fibular condyle ^{partly} ~~not deeply depressed~~ ^{as in *Bucconia*}
- ⑥ External intermuscular line sweeps posteriorly above middle of shaft then turns abruptly externally to bare site of ligamentous attachment on external surface of head.

- ① Proportions of femur close to *Vultur gryphus*; *Gymnophis* more columnar with stouter shaft & less flared ends
- ② Anterior flexure of trochlea occurs also in *Vultur* but the ridge is bordered by only one pneumatic foramen & is not undercut. There is less ant. flexure in *Gymnophis* but the pneumatic orifices bordering the ridge are similar to those in *Bucconia*
- ③ Obturator ridge diagonal in *Vultur* but area internal thereto is gradually, not abruptly, depressed. In *Gymnophis* the obturator ridge is more nearly parallel to the long axis of the bone, the abrupt depression int. to the ridge resembles *Bucconia*
- ④ The rotular groove is difficult to measure, but is seemingly broader in *Gymnophis* & about the same as *Bucconia* in *Vultur*
- ⑤ The muscle scar above the fibular condyle is greatly depressed & markedly bordered in *Gymnophis* & faces posteriorly. It's more rugose in *Vultur* than in *Bucconia* but not as much as in *Gymnophis*.
- ⑥ The external intermuscular line in *Gymnophis* runs more directly upwards to the lig. attachment without deviation as in *Bucconia*. In *Vultur* the condition is nearer *Gymnophis* than *Bucconia* but has slight sweep.

Reagyns

Not
home

Left complete

B6259, B3358, B5693, B1437, B1404, B5823

Right "

B6910, B7803, B4989
(max broken)

Prox left

B6372

NOT
HOME

Right dist.

B5950, B1574, B3388, B6620, B2599 (just lacks head)

Left "

B7460, B6938, B5580

Right prox

B2257

Modern forms studied (femora)

Gymnagys

141, 371, 1052, 555, 31, 302, 371 (all LACM)

Valtur

218, 1734 (all LHM)

• Pteropoda Genus vs. Coragyps, Cathartes & Sarcophaga

- ① Narrowness + prox. flange absent & V. ultra
- ② ant. flexure of trochantin crest vaulted & Sarcophaga
pneumatized about equal to Pteropoda in $\nearrow$
- ③ Area internal to obturator ridge depressed in Cathartes
but not Coragyps or Sarcophaga. But ridge is ~~thinner~~
parallel to shaft (as in Symptetrus)
- ④ No other species has the large flat muscle scar -
they are all smaller
- ⑤ Cathartes the only genus in which the ext. intermuscular
line curves abruptly posterior then cut against
posterior edge of trochantin

FEMUR

Material available: Eleven complete (or nearly complete),
 right B3576*, B4989, B7803, left B1404, B3358, B3379*/B5693, B5873,
 B6259, B7493; two lacking proximal end B2599 and B6910; six distal
 ends B1437, B1574, B3388, B5950, B6620, B7460; two proximal ends
 B2257 and B6372, one shaft with partial distal end B6938.

Description: Proximal end flaredth notably from slender shaft^{and the}
 trochanter^{has a} with decided anterior flexure; ^{the} external intermuscular line
 curved^{es} anteriorly just above middle of shaft then swerving^{es} abruptly
 outward again at the level of the long muscle scar on the trochanter;
 the attachment of the round lig. on head is narrow and deep
 anterior contour of proximal end (from trochanter to head) a smooth curve.
 distally muscle scar above fibular condyle is larger and rugose, not depressed
 ^ Comparison: In Gymnogyps the shaft is sturdier and more columnar
 with less marked proximal flare than in Bregyps, the trochanter is
 less anteriorly flexed, the external intermuscular process^{line} is a nearly
 the attachment of the round lig. on head is broader
 straight line along the external side of the shaft; ^{on the anterior contour}
 of the proximal end there is a slight bulge adjacent (medial) to the
 trochanter; the muscle scar above the fibular condyle is ~~markedly~~ well
 depressed and markedly bordered. In all the above-mentioned characters
 Vultur more closely resembles Bregyps than does Gymnogyps, ^{tho} but the
 shaft is straighter in lateral profile, the area bordering the flexed
 trochanter is ~~bordered by only one pneumatic foramen~~ is less pneumatic,
 and the muscle scar is slightly more depressed than in Bregyps but
 less marked than in Gymnogyps.

Jan. 16, 1973

TIBIOTARSUS

include distal bridge

Material available: Five complete, B7026 and B7746 (in mounted specimen), B5878[✓] (illus), B4039, B6414 + B6413; four proxiaml ends B6404, B3361, B2319⁴², B2115; nine distal ends B7085, B6477, B5156, B1074, B7244, B1593, B2116, B3383, B8313; one lacking proximal end only J9629[✓]; shaft only B7951

Description: External cnemial crest long, extending to level of proximal tip of fibular crest and below level of inner cnemial crest with well-marked muscle line directly below the crest descending distally approximately parallel to fibular crest. In these respects Breagyps resembles Vultur; in Gymnogyps the external cnemial crest is shorter, terminating about on a level with the end of the inner cnemial crest and above the proximal tip of the fibular crest.

Distally, the external condyle (viewed anteriorly) is high proximo-distally, and inclined externally, with blunt proximal border clearly set off from the shaft; the ligamental attachment above the condyle is prominent with a small foramen lateral thereto. Again resemblance is closest to Vultur except that the condyle is proximo-distally shorter. ^{also,} In Gymnogyps the condyle is shorter, and is less laterally inclined and less distinctly set off from the shaft; the ligamental attachment above the condyle is less developed and the foramen is above rather than lateral thereto.

147
130
297
160
121
281
168
133.5
298.5
124
154.3
19
298.3

Tibudarsus Breagyps Sept. 1971

check this
B2314 023192

L¹
B7951
shaft
a little
dist.

L¹
J9629
only
proximal
minim

Material available: 4 fine complete, B5026 and B7546 mt
(in mounted specimen) B5878 (figure), B4039, B4414 dist + 6413 prox
four proximal ends, (right) B6404, (left) B2319, B2115
nine distal ends (right) B7085, B6477, B5156, left B1074,
B7244, B1593, B2116, B3383, B8313, J9629 (shaft + dist)
dist? prox gone

Characters: ① External crestial crest long, extending 5/10
and below inner crestial crest
level of proximal tip of fibular crest, with well-marked
muscle line, directly below, descending still further
distally approximately parallel to fibular crest, (the vertex)
high (proximo-distally) inclined
② External distal condyle (recessed anteriorly),
externally, with blunt proximal border clearly set
off from shaft, ③ ligamentous attachment above
The condyle prominent, with small foramen lateral thereto.
④ Internal condyle (recessed laterally), moderate, depressed
thinly bordered.

Comparisons: Vultur resembles Breagyps in the length
of the crestial crest - muscle line below, in Gymnogyps
the crest is shorter, semicircular, ^{about on a level with the end of the inner crestial crest} and above the proximal tip
the fibular crest. Vultur also resembles Breagyps
in the shape and position of the external condyle and ^{recessed}
the development of the ligamentous attachment above ^{but the condyle is shorter}
In Gymnogyps the condyle is ^{additionally} ~~more~~ ^{protruded} proximally
less laterally inclined & less distinctly set off from shaft; the
ligamentous attachment is less developed & the foramen is
above it. Both Vultur & Gymnogyps the internal condyle
~~is less developed & less lateral (recessed laterally)~~

Superceded by May 10, 1972

Material Available: Five complete Nos. B 7026* and B7746* (in mounted specimen), ^{photo R m} B5878, ^{R m} B4039, ^{Le R m} B6414; ^{and} nine distal, ^{and} four proximal ends Nos. ^{R dist} B7025, ^{L dist} B1074, ^{L dist} B7244, ^{L dist} B1593, ^{L dist} B2116, ^{L dist} B3383, ^{L dist} B8313, ^{R dist} B6477, ^{R dist} B5156, ^{R prox} B6404, ^{L prox} B2115m, ^{L prox} B2314 and ^{R prox} B3361. ^{B 7951} ^{Left} ^{Right}

D Description: ^① External cnemial crest long and straight with ~~ridge~~ continuing distal thereto well marked down the shaft to a point on a line with or distal to the proximal end of the fibular ridge; connection of crest with shaft stands out as a flange which continues into a short ridge to a point on a line with or distal to the proximal end of the fibular crest; ~~intercondylar condyle~~ (lateral view)

^② lateral side of internal condyle only moderately depressed;
^③ ligamental attachment above external condyle prominent with small intercondylar distal contour symmetrically ~~curve~~ and broadly curved; ^④ foramen external thereto shaft straight in lateral profile.

Comparisons: External cnemial crest longer and straighter than in ^{or Sarcoramphus} Gymnogyps, resembling ^{in modern} Vultur in this respect, but the surface at the proximal tip of the crest is narrower and more convex than in the Recent genus; the lateral surface of the internal condyle is less deeply excavated and less heavily margined than in any of the living genera, though closest to Coragyps and Vultur; the distal contour of the intercondylar area is more symmetrical than in Gymnogyps; ~~Vultur and Coragyps~~ and though the other genera are more nearly symmetrical ~~they~~ the contour is not the same as in the fossil; the ligamental attachment above the external condyle is less developed and the foramen more proximal in position in Gymnogyps; the fossil is closer to Vultur or Sarcoramphus, but even in these genera the foramen is more proximally placed. The shaft is straighter than in any of the modern genera.

Treagus tibiotarsus vs.
Cathartes coragyps, *Sarcorampus*

- ① External enamel crest is long only in *Valer*
Tends to be long in *Cathartes* but here the anterior
crest is very small in ant. extent
- ② External condyle ~~flares~~ ^{prominences} externally in
Coragyps but is more pointed prox'ly? ~~Lip attach~~
Condyle ~~shorter~~ + not so ext
- ③ Lip attachment above condyle is less developed in
Coragyps than *Treagus* + suprasternal ridge
is wider (higher) ^{flatter} ridge is flatter in *Sarcorampus*

Material available: Line complete, B34039, B5878 (illus)

B 6413 + B 6414 (prox. + distals that fit together), B 7026* and B 7746*
 (one looking only prox. end, 19629; where?)
 1 four proximal ends; B 2115, B 2314, B 3361, B 6464; distal
 ends; B 1074, B 1593, B 2116, B 3383, B 5156, B 6477, B 7244, B 8313

Character: External enamel crest with sharply compressed
 margin extended, ^{below level of internal enamel crest} approximated to level of proximal tip of
 fibular crest; distally, external condyle (viewed anteriorly) inclines
 externally with blunt prox border; ligamentous attachment above
 external condyle prominent with small foramen on the external border;
 supratubercular bridge, tending to be level or slightly convex
 and longest ~~vertical~~ line which proceeds above it forms a sharp
 ridge

Comparisons In *Gymnogyphus* external enamel crest
 shorter ^{with} less sharply compressed margin, Vultur similar
 to *Brachyphs*; distally, external condyle in *Gymnogyphus*
 straighter than in *Brachyphs* + tapering proximally, Vultur
 also straight, with proximal border rounded; ligamentous attach-
 ment above external condyle reduced in *Gymnogyphus*, foramen
 in both *Gymnogyphus* + Vultur proximal to the attachment; the shape of
 the supratubercular bridge is closer to *Brachyphs* in Vultur than in
Gymnogyphus. In the latter the bridge is depressed medial to the
 internal border. In neither Recent genus is the longest vertical
 line as sharply ridged as in *Brachyphs*, the Vultur is closer
 in this respect

T. bivaricus

at Mus.
March 28, 1973

Ext. crenular ridge longer than int. cren. ridge
Like V, Q, Mar. Shar. Shar., Cor. Shar.,

Int. crenular crest less extl. deflected than V

" " higher ^{above proximal} & more depressed on int. surf than Q. ^{or S} Cor.
closer to V in this but lacks ext. deflection of V.

Crest int. crest very small & scarcely raised beyond
artic.

Distally Ext. cond. (ant. view) sides parallel so
condyle rather narrow with blunt prox. end. Prox. projects
ext. to shaft. More tapered in S & V & in S. not projected
laterally.

Lig. attach. above ext. condyle larger than in other
condors, ptd. prox. lig. extending to level of upper end
of supratubercular ridge with small foramen on its
~~at base~~ extl. near base. Attach. less prox. extension
in V & Q. & foramen ~~at base~~ ~~above it~~ ~~is not present~~

Int. lig. prominence less raised than Q. & ruin
of condyle in int. view less heavily bordered (espec.
act'l). In this respect B is closer to V. (Sar. has
small lig. prom. but heavier ruin, more like S.)
Cor. has marked tub. for lig. prom., lower down

OLD
Cathartidae

Rancho La Brea
for comparison with
cave

The Cathartidae of Rancho La Brea include two small vultures, Cathartes aura, the common Turkey Vulture of today, and Coragyps occidentalis, an extinct form closely related to the living Black Vulture, Coragyps atratus; and two Condors, Gymnogyps californianus, the California Condor, still in existence, and Vultur clarki, an extinct ^{bird} ~~species~~ of similar size and proportions.

Strangely enough the Turkey Vulture, the common form today, is but scantily represented in the Pleistocene, while the extinct Black Vulture type was ~~very~~ ^{present} abundant. This fact has been previously noted on many occasions, and the writer has considered it of sufficient importance to use in age determination of questionable Quaternary deposits (Howard and Miller). Of the Condors, Gymnogyps californianus is more abundant than Vultur clarki.

Coragyps

Sternum

Material available.-- ^{Seven} ~~Eight~~ specimens, all chipped and worn; in none is the posterior ~~complete~~ border preserved; the carina is nearly complete in three.

Characters.-- 1, Apex of carina approximately in a line with last costal process, from this point sloping upward both anteriorly and posteriorly though at a greater angle posteriorly; in none of the modern genera is the apex so far anterior -- (except in Cathartes where the carina has a continued upward slope from the anteriormost tip) -- nor is the anterior slope so well marked; Vultur and Coragyps are closest to the fossil; 2, length of costal margin, relative to breadth of sternum, less than in Gymnogyps, equal to Vultur; 3, Articular facet of ventral lip of coracoidal sulcus broadening at lateral extremities by flaring dorsally (similar to Vultur, but unlike Gymnogyps, Coragyps or Sarcoramphus).

287
287

Sternum

	a	br.	bar	length	Ratio	apex	car. to	ant. post	apex	length
			Ratio	edge	ab					yx
B 6669	59.4	71.7	82.896	62.3	86.7	58.0	66.7	46.6	69.1	
B 1428	61.3	73.8	82.890	65.5	88.7	64.2	71.1	58.4	75.3	
B 4554	58.54	74.7	78.3?	62.12?	83		66.8	44.9	67.3	
B 5599		72.8		71.1	98.3					
B 3372		76.7		64.3	837					
B 1403		71.3		74.3						
B 6012		71.3		75.4						
B 1889	53.4	72.1		67.7	940					
B 5319	61.2	73.8		71.3	96.5					
B 371		67.8		64.0	90.6					
B 302		67.8		63.3	94.5					
B 6011		73.7		69.0	93.5					
		70.1		68.5	97.7					
B 7229		72.5		72.0	99.8	77.0				
218		74.3		58.9	79.4					
B 716 Co.		42.5		34.7	82.1					
686 San		50.0		48.3	96.5					
18 Cath		40.8		25.2	69.1					

apex
car. to
ant. post
apex
length
edge
yx

rel br. & length Gynno & San line up together
Ullus, Cor. & clarkii " (Cath broader than all)

59.7
13.5
73.2

a
 Breadth
 at pt
 interest
 space
 b
 Length
 cut
 margin
 Stem
 ratio
 ba

San					
737	43.6	38.0	38.0	46.4	106.1
686	46.2	38.0	77.1	47.6	103.0
cast					
18	36.7	21.3	58.1	28.5	77.7
Cor.					
716	40.0	26.3	65.7	34.2	87.3
228	38.7	28.0	73.7	39.8	102.6
Vul					
218	64.1	51.6	80.6	61.2	95.4
Vice					
B3312	65.6	53.8?	82.1	64.3	97.8
B1428	66.2	54.6	82.5	67.5	102.1
B5669	65.5	44.6	65.1	62.3	95.1
B4554	67.2	49.8?	74.3	61.6?	91.7

Scapula

Material available.-- Six right, seven left scapulae.

Characters.-- The chief distinguishing characters of this element lie in the acromial region. In general, this region is broadly rounded and low, much as in *Gymnogyps*, but the tubercle at its antero-ventral extremity is less prominent than in the latter ^{and} ~~and~~ in *Vultur*, resembling *Sarcoramphus* more closely in this character. The fossil differs from all of the modern genera in that at its postero-dorsal extremity, the acromion arises from the shaft abruptly and acutely.

	a	b	Scapula			a	b	Ratio
	Pr.	Depth	Ratio	Length	Ratio	Pr.	ht	x/b
B1671	29.9	21.4	71.9	15.2 9.7	63.7	27.5	18.4	84.6
B6020	32.2	21.8	67.2	16.3 12.1	74.3	30.3	19.2	88.1
B6332	31.2	22.0	70.6	15.1 9.8	64.8	28.3	18.9	86.1
B7558		22.0		15.0 9.8	65.3	28.4	19.5	86.8
B4418				14.4 9.7	67.3			
B3482				14.2 9.6	67.6	28.2		

31	29.0	20.1	69.4	15. 10.7	71.4	27.8	19.6	97.6
31	27.4	20.3	74.2	13.8 10.3	74.7	26.6	20.0	98.1
B7960	32.0	22.9	71.4	15.5 11.7	73.6	29.9		
B5014		23.7		15.8 11.3	71.5	29.8	21.7	98.6
B5824		22.5		16.0 12.0	75.0	30.7	20.8	92.5
B7933		22.9		15.6 11.3	72.5	31.0	22.3	97.3
B6809		23.3		14.8 11.1	75.0	28.9	22.3	95.9

~~Handwritten scribble~~

	br	diff		
B 7730	21.7	18.6	21.9	22.4
B 8062	20.7	17.1	20.7	21.3
B 2642	19.7	17.1	21.	
			22.7	23.4
			21.4	22.6

V. clarki

Ulna

Material available.-- Ten proximal ends, ^{seven} six distal ends.

Characters. -- In view of the absence of a complete ulna assignable to this species, it is not possible to assert definitely that the proximal and distal ends here discussed actually belong together. However, the character of the intermuscular lines proximally appears to be diagnostic and two of the specimens with distal end are of sufficient length to include a good portion of these lines. Furthermore, no other specimens of either end can be distinguished from Gymnogyps. The writer is reasonably certain, therefore, that the proximal and distal ends here described are both correctly assigned to clarki.

Distal end: (1) External condyle more obliquely placed than in Gymnogyps; Vultur closer though not identical. (2) Facet of the external condyle comparatively broad, narrowing gradually and ending proximally in a point; closest to Vultur in this though broader and extending a bit further proximally; this facet in the other species narrowing more abruptly and extending with more nearly parallel sides to its proximal tip. (3) On the palmar side the distal end differs from all of the other genera in the presence of one or more bumps just external to the distal radial depression and in most specimens extending proximally a short distance up the shaft. (4) ~~The~~ ^R radial depression blending into the shaft without any interruption in the way of ridges or swellings; this condition most closely approximates Vultur. (5) Carpal tuberosity appearing to be more angular (less smoothly rounded) than in Gymnogyps.

Proximal end: Among the cathartids there appears to be very little specific difference in the region of the proximal articular surface and olecranon; the region immediately distal to the articular surface

particularly on the palmar and internal sides is more characteristic. In alarki (1) the impression of the brachialis anticus, as viewed from the internal side, is depressed proximally with respect to the surrounding proximal area, somewhat as in Coragyps and Sarcoramphus though to a less marked degree; ~~that~~ in Gymnogyps, Vultur and Cathartes the impression blends almost imperceptibly into the proximal part of the bone. (2) Border of this impression, toward anconal side of bone, undercut for no more than half the length of the impression and below this point rounds off more or less smoothly into the shaft, the bone in this region having a tendency to convexity. (3) In palmar view, proximal radial depression appearing more pneumatic than in Gymnogyps and its borders well rounded with little suggestion of the angularity of ridges occurring in some specimens of Gymnogyps or Vultur; there is no ridge running from the external condyle to the muscle attachments. (4) Principal intermuscular line situated farther toward the internal side than in Gymnogyps and Vultur, with the next line branching off from it at an acute angle, then paralleling it closely as it runs proximally along the front (palmar side) of the impression; this condition differs from any available specimens of the other genera.

V. clarki

Ulna

Material available.-- Ten proximal ends, six distal ends.

Characters.-- The characters distinguishing the distal end of this ~~element~~ ^{specimens} ~~in clarki from Gymnogyps~~ ^{in view of} are more marked than those of the proximal end. In view of this fact and the absence of a complete ulna assignable to this species, it is not possible to assert definitely that the proximal ^{distal} ends here discussed actually belong ^{together} with the distal specimens. However, the characters of the intermuscular lines proximally appears to be diagnostic and two of the specimens with distal end are ~~xx~~ of sufficient length to include a good portion of these lines. ^{Further more, no other specimens of the indicated species from the Gymnogyps distal ends} The writer is reasonably certain, therefore, that the proximal ends here described are correctly assigned to clarki.

Distal end: (1) External condyle more obliquely placed than in Gymnogyps; Vultur closer though not identical. (2) Facet of the external condyle comparatively broad, narrowing gradually and ending proximally in a point; closest to Vultur in this though broader and extending a bit further proximally; this facet in the other species narrowing more abruptly and extending with more nearly parallel sides to the proximal tip. (3) On the palmar side the distal end differs from all of the others genera in the presence of one or more bumps just external to the distal radial depression and in most specimens extending proximally a short distance up the shaft. (4) the radial depression ^{blends with the shaft up to} is well excavated ^{any interruption in the way of ridge or swelling; this cond. more closely approximates Vultur.} and the carpal tuberosity stands off from it distinctly.; this process appears to be more angular (less smoothly rounded) than in Gymnogyps.

Proximal end: Among the cathartids there appears to be very little specific difference in the proximal articular surface and olecranon; the region immediately distal to the articular surface particularly on the palmar and internal sides is more characteristic. In clarki (1) the impression of the brachialis anticus, as viewed from the internal side, is depressed

proximally with respect to the surrounding proximal area, somewhat as
and
in Coragyps, Sarcoramphus though to a less marked degree; in Gymnogyps
Vultur and Cathartes, the impression blends ~~in~~ almost imperceptibly
into the proximal part of the bone. (2) The border of the impression
toward the anconal side of the bone is under cut for no more than
half the length of the impression and below this point it rounds off
more or less smoothly into the shaft, the bone in this region having a
tendency to convexity. (3) In palmar view, the proximal radial depression
appears more pneumatic than in Gymnogyps, and its borders are well
rounded with little suggestion of the angularity of ~~ridged~~ occurring
in some specimens of Gymnogyps or Vultur; there is no ridge running
from the external condyle to the muscle attachments. (4) The principal
~~line~~ intermuscular line is situated farther toward the internal side
than in Gymnogyps or Vultur, with the next line branching off from it
at an acute angle, then ~~parallel~~ing it closely as it runs proximally
along the front (palmar side) of the ~~impression~~; this condition differs
from any ^{available} ~~of the~~ specimens of the other genera ~~at hand~~.

Vultur clarki

Carpometacarpus

Material available.-- Eight right, seven left.

Characters.-- 1, Point of ~~junction~~ of tuberosity of M2 with shaft more distal in position than in any of the other forms; 2, proximal metacarpal symphysis equal in length to Vultur (averages about 28.4% of length, and shorter than any other form (others run from 31.8% to 35.3%); 3, metacarpal I ~~is less~~ less prominent than in other forms, and directed upward slightly (depth of proximal end relative to length averages 22.0% in ~~the~~ the fossil and from 23.2% ~~is less~~ to 25.8% in the other forms).

Brachypterus

II Carpus

	^a Length	^b Prox. Depth	^c Prox. ht	^d MI ht.	^e sym. int. side	^f dist. sym. ext. side	✓ Ba	✓ ca	✓ da	✓ dc	✓ ea	✓ fa
J9402	145.8	32.0	34.3	24.3	40.5	18.1	22.0	23.5	16.7		27.8	12.7
B3154	138.8	30.9	33.8	23.8	40.5	16.0	22.2	24.3	17.1		29.2	11.5
B2181	143.0	31.4	35.0	23.7	41.9	16.4	21.9	24.4	16.5		29.3	11.4
B21208	141.6	33.7	33.5	22.9	47.1	15.8	23.8	23.6	14.6		33.2	11.1
B2667	142.4	31.2	34.3	22.6	39.8	14.6	21.9	24.1	15.8		27.9	10.2
B7608	139.3	31.2	34.0	22.5	40.1	17.3	22.3	24.4	16.1		28.7	12.4
B3425	143.2	31.0	35.4	24.9	39.3	16.6	21.4	24.6	17.3		27.4	11.5
B5331	141.8	31.6	36.2	24.7	40.2	16.7	22.3	25.5	17.4		28.3	11.8
B6395	143.5	31.1	35.1	23.4	41.7	13.9	22.1	24.4	16.3		29.1	9.7
^{gym} B7634	138.4	31.7	33.3	21.9	41.9	16.5	22.8	24.0	15.8		30.3	11.9
B6734	137.9	33.2	34.2	23.6	44.8	15.9	24.1	24.8	16.7		32.8	11.5
B4668	135.5	33.1	34.5	24.0	42.0	14.2	24.4	25.4	17.7		31.0	10.4

<u>Bulfinch</u>	136.8	31.7	34.1	23.1	39.5	21.0	23.2	24.9	16.9		28.9	15.4
<u>Scu</u>											32.9	11.2
737	86.4	21.2	23.0	14.3	25.4	9.7	24.5	25.6	16.5		32.8	11.7
686	89.2	23.2	24.9	15.2	29.3	10.5	26.0	27.9	12.0			
<u>Cor</u>											32.3	11.1
716	75.9	17.8	18.7	12.2	24.5	8.5	23.4	24.6	16.1		33.1	12.0
228	76.0	18.2	19.1	12.2	25.2	9.2	24.6	26.1	16.7			
<u>Cath</u>											35.3	13.2
18	82.1	21.2	20.3	14.7	29.0	10.9	25.8	24.7	17.9			

* Measured in center of tubercle at back (not on either ext. or int. crest of tubercle)

Femur

Material available.-- five right, nine left complete or nearly so; six distal end, two proximal end, one shaft with part of distal end.

^{1,}
Characters.-- Trochanteric region having more noticeable forward flexure than in any of the modern genera; 2, attachment of round ligament narrow antero-posteriorly and deeply tunnelled into ~~the~~ head of femur (others different in shape, size and depth); 3, fibular condyle shorter antero-posteriorly than *Gymnogyps* (similar to *Vultur*); 4 distal end broader relative to length of bone and to depth of distal end than in the modern genera.

Genus

	a length from head to int. cond.	b prof.	c depth	d dint.	e	Bathos	ca	cb	da	ed	ea
B5580	137.6	39.1	29.2	37.8	30.0	28.4	74.7	27.5	79.5	21.8	
B6259	129.3	38.2	28.7	35.0	27.7	29.5	75.2	27.0	79.2	21.1	
B3379	134.5	38.2	29.1	36.2	28.5	28.4	76.1	27.4	77.5	21.1	
B2984	140.5	40.4	—	39.6	31.0	28.7	—	28.2	78.4	22.0	
B5873	136.8	39.1	28.8	38.3	29.3	28.6	73.6	28.0	76.5		
B4929	138.1	39.8	29.9	37.6	30.0	28.8	75.1	27.2	79.8		
B7493	140.4	41.3	—	38.3	28.0	29.4	—	27.2	73.1	21.7	
B3358	139.1	39.5	—	38.5	—	28.2	—	27.6	—		
B7803	130.5	—	—	36.2	28.2	—	—	28.0	77.3	21.6	
B1404	137.2	41.8	29.3	37.5	29.7	29.8	71.4	27.3	79.3	21.6	

Vulturn	138.3	39.1	30.5	37.0	31.1	28.2	78.0	26.7	84.0	22.4	
218											
condor	134.5	36.7	28.3	34.8	28.5	27.2	77.3	25.8	81.9	21.2	
371											
302	133.0	36.1	27.7	34.3	27.5	27.1	76.8	25.8	80.2	21.6	
B8077	136.4	37.8	27.4	35.1	29.3	27.7	72.5	25.7	83.5	21.4	
B3093	131.4	42.6	31.5	38.5	31.6	28.1	74.0	25.4	82.4	21.8	
San								25.2	81.4		
686	93.4			24.1	19.6			26.3	79.1		
737	93.8			24.7	19.5			29.4	84.3		
Cor	86.6			20.3	17.1			23.7	82.3		
228				19.7	16.2			24.9	86.1		
716	83.3			16.5	14.2						
caugh	66.4										
18											

$$\begin{array}{r}
 37.5 \\
 \times 8 \\
 \hline
 3000 \\
 2970 \\
 \hline
 3000
 \end{array}$$

$$\begin{array}{l}
 29.3 - 26 \\
 29.3 - 26.5 \\
 31.3 - 25.4 \\
 29.6 - 26.5
 \end{array}$$

Vultur clarki

111
Tibiotarsus

Material available.-- Three right, 2 left complete or nearly so; four proximal, nine distal end, 2 shafts with both ends incomplete.

Characters.-- 1, outer cnemial crest longer and straighter from its proximal extremity to its connection with the shaft than in *Gymnogyps* (closer to *Vultur* in this respect, though surface at proximal tip of crest narrower and more convex); 2, anterior portion of internal condyle (as seen in lateral view) less deeply excavated and less heavily margined than *Gymnogyps*, *Sarcoramphus* or *Cathartes*, closer to *Coragyps* and *Vultur* though not identical; 3, ligamental attachment above external condyle prominent; a small foramen external thereto (attachment less developed in *Gymnogyps* and foramen proximal to it; fossil closer to *Vultur* or *Azeoramphus*, though even in these genera the foramen is more proximally placed).

Box	Weight	Length	Width	Height	Volume	Weight	Length	Width	Height	Volume	Weight	Length	Width	Height	Volume
B7026	228	15.8	27	23.4	69.4	24.8	13.0	23.4	69.4	24.8	13.0	23.4	69.4	24.8	13.0
B7786	228	15.2	124	23.5	66.7	25.2	47.3	830	55.3	10.3	11.1	93.3	20.6		
B8019	246	28.7	148	35.8	128	23.1	68.5	24.5	42.1	13.2	16.5	80.2	10.4	11.3	94.3
B6413	241	34.09	22.5	24.2	45.4	16.1	10.6	11.4	93.0	21.5					
B5838	247	24.8	15.1	13.0	23.4	69.4	24.2	47.8	13.7	10.7	11.1	96.6	22.1		
B3163	222	29.0	15.1	35.1	123	23.0	68.0	22.5	49.1	13.0	15.8	82.7	10.3	10.1	102.1

	lit. to cord.	Depth same	Rain
59629	20.3	23.8	85.4
62093	21.0	23.8	88.4
59627	21.6	23.3	92.7
B7746	21.2	22.9	92.7
55878	21.9	24.2	90.5
B7024	20.8	22.0	92.3
B3565	20.4	23.5	86.9
59628	21.5	23.7	91.5
B7587	21.5	23.5	91.5
B7746			

218	2310	28.5'	33.2	24.7	24.1	47.1	12.3	15.2	81.0	10.7	10.4	102.2	21.3
737	1620	19.4	23.5	16.5'	15.8	35.1	11.9	14.5	82.5'	10.1	9.7	104.6	21.8
686	163	20.0	24.2	17.0	17.3	57.7	12.2	14.8	82.7	10.4	10.6	97.4	22.8

Gymnophis longist.

[illegible]

C
Cervical vertebrae: The axis has been briefly described
~~(Howard, 1969:5-6)~~
(Howard, 1969:5-6) in connection with the discovery of a similar
specimen in the Pleistocene deposits of Tequixquiac, Mexico. The
characters distinguishing Breagyps from Gymnogyps and Vultur in
this element are (1) ^{the} facets of the postzygapophyses are parallel,
(2) the posterior articulation of the centrum is broad and is
directed iposteriorly rather than dorsally, and (3) the neural spine
is broad and stubby. In both the modern genera the facets of the
postzygapophyses are aslant of the longitudinal axis of the vertebra,
the posterior articulation of the centrum is narrower and faces more
dorsally, and the neural spine is more slender.

Using the vertebral column of Gymnogyps as a point of refer-
ence the four remaining cervical vertebrae appear to represent
(a) cervical number 3 or 4, (b) two specimens of cervical number 5
and (c) two specimens of cervical number 6. In specimen a, as in
the axis, the facets of the postzygapophyses are parallel in position
and the posterior articulation of the centrum faces more posteriorly
than dorsally. Also, as in the axis, the neural spine is broad ~~thick~~
and stubby. These characters distinguish the Breagyps vertebra from
those of both the modern condor genera.

The two specimens identified as cervical no. 5 ^{differs from both G & V Anas} more nearly ^{perhaps}
^{more nearly like} resemble this element of Gymnogyps than that of Vultur. In Gymnogyps
there are three cervicals between the axis and the first vertebra in
which the postzygapophyses have a V-shaped spread. In the two
specimens of Vultur at hand, there are only two cervicals before the
and cervical no. 5, therefore has a V-shaped posterior contour.
one with the forking postzygapophyses/ The two fossil bones have
a broadly ~~posteriorly extended~~ U-shaped posterior contour, more deeply
indented than in Gymnogyps and with less squared lateral margins,
In these fossil specimens the ^{parallel} position of the anterior facets
reflects the condition already described for The posterior facets of specimen a.

The two specimens identified as cervical no. 5 differ from both *Gymnogyps* and *Vultur*, though more nearly resembling the former. In *Gymnogyps* cervical no. 5 ~~has~~ is straight-sided and the posterior contour varies from a nearly straight line to a shallow broad U-curve. In *Vultur*, no. 5 ~~has a V-shaped posterior margin~~ is shaped very much as in the following four cervi

The two specimens identified as cervical no. 5 ^{has a} ~~is~~ more broadly and deeply U-shaped posterior margin and ~~is less square~~ ^{is} less square in overall shape than in *Gymnogyps*, but ~~is not~~ ^{has a} ~~has not~~ yet does not have the deep-V-shaped posterior contour of *Vultur*. The ~~posterior~~ ^{posterior} facets of the postzygapophyses are parallel and narrow, ~~in the fossil specimen the parallel position of the~~ ^{in this element in} the facets of the prezygapophyses ~~reflects~~ are also parallel, reflecting the condition already described for these of the postzygapophyses of specimen a.

The two specimens of cervical no. 6 have the deep V-shaped ~~anterior~~ posterior contour of this element in *Gymnogyps* ~~and~~ but the prezygapophyses face more anteriorly. In this respect they resemble cervical no. 5 in *Vultur*

~~Writing the~~

The two specimens identified as cervical no. 5 more nearly resemble this element in Q. than in V. In Q. there are three cervicals between the axis and the first vertebra in which the postzygapophyses ~~are spread apart~~ have a V-shaped spread. In the two specimens of V. at hand there are only two and therefore no. 5 in V has a V-shaped posterior contour. The two fossil bones have a broadly U-shaped ~~ant.~~ post. contour, rather more deeply so than in Q. (~~in which some individuals have a straight~~ ^{even} ~~post contour similar to cervical 4~~) and the lateral margins are less square. In these specimens the parallel position of the facets of the postzygapophyses reflects the condition already described for the ~~postzyga~~ posterior facets of specimen a.

Vertebrae: The atlas ^{has been previously noted} and briefly described (Howard 1966) in reference to the assignment of a specimen of this element from Tequixquiac, Mexico.

Articular facets on postzygapophyses shallow and parallel to antero-posterior line of the vertebra; posterior face of centrum broader than high (measured through center) and facing almost directly posterior. Neural canal (anterior view) inverted V shape and ^{anterior} articular facets widespread and facing slightly upward.

In both *Gymnogyphus* and *Vultur* the facets on the postzygapophyses are deeper (more cup-shaped) and are set at an angle to the antero-posterior line. The centrum is wider than high in *Gymnogyphus* (as in *Bucagys*), but narrower in *Vultur*; in both the modern genera the centrum faces more upwards than posteriad. *Saiconia* is more like *Bucagys* in this character (facing posteriorly). Anteriorly the dorsal contour of the neural canal is rounded in *Gymnogyphus* and *Vultur* and the articular facets face more laterally.

Length of vert through centrum 14.9 mm (Mexican specimen)
Have not located G 9346 at this date
July 1973

6
5
19
11
10
12
7
15
5
11
12
11
5
129

Val. = 18 cew. + at least a v
 8. = 19 " " " " "

G 9423 = postaxis cew, #1 or 2 facets are parallel to center at top of postaxis - not in center

G 5437 } = " " " 3 (ant. facets parallel post facets *
 B 4425 } post contour V shaped as in narrow

4? (B 3945 " " " # 3 of some g. (V in vulture)
 (B 3841 " " " " 4 or 5 of g. as for V shaped postaxis

but ant facets face more antly than upward as in
 g. 3 AMM

The spine + v are as in g. 4 or V 3

The position of ant. facets are as in ~~g. 4~~ or g. 3 or V 3

postant 3gg, less medially tipped more flat
 spine centrally placed (more ~~post~~ ant in g.)

X G 3437 has narrow post facets (broad in g.
 narrow in V)
 B 4425 " " " (but shape is bet. the 2)

wh. g.
 9423 = 3 post facets parallel
 5437 = 5 U post but facets narrow
 4425 = dorsal spine centered as
 in g. ant facets parallel
 3945 = 6 V post but ant facet
 3841 = flatter less medially
 tipped (more ant faced)
 has dorsal spine midline
 (more ant in g.)
 no spine on 4 in V
 spine occurs on 5 in V
 and more ant

Vulture has
 3-4 square
 5-8 V. contour post
 5 in Vulture
 has flat post
 facets facing
 ant. (less
 up than 3945 pro.)

g. has
 1-2 square
 3 has V post
 ant
 4-6 V. post center
 # 3 fossil
 has only
 narrow
 connection
 from post
 zygapophyses
 antly, no
 element
 less square
 than g.
 post facets
 narrow

128
 16
 144

10 + atlas
Vertebral Cervical atlas = 1 axis = 2

B1566 = #3
G9423 = #3 or #4 OK B.
B1712 = #4
B2567 = #4
D2151 = #5
B6263 = #4
B34946 = #5
G9122 = #5
G9346 = atlas = vert #2

see next sheet

~~2 Thoracic~~

B3541 = #8 (= Thoracic #1) only thor. with rather high spine
B3948 = #8
G9437 = #6

In G. atlas + 3, 4, 5 have ^{cupped and} post. art. facets ~~at~~ angle to axis of
Vertebra ^{post. art.} ~~anterior~~ max. lateral

Breapp G9423 + axis G9346 these facets are parallel to axis of vert
and spine thicker + stouter than G. ~~in G9423~~

post. centrum broader than high + fairly more post than upland

G3437 which I take to be ~~cervical no. 1~~ ^{no. 2} ~~the~~ first of ~~the~~ those which have ^{split} bifurcated post. zyg. has the
ant. facets parallel + facing slightly dorsal + posterior
not flared as in G.

It ^{has been} ~~was~~ previously noted that ^{in contrast an axis has 2, with one} ~~the axis of~~ Breapp's

that the post facets etc -

cent
and
broad
+ post
divided

{ There are ^{more ant} ~~two~~ other cervical in the coll. that also
~~has~~ this char. + a third ^{broad} in which the ant. facets also are parallel. A third specimen
suggests the 1st of those with post zyg separated (but less spread than G.) also
has parallel ant facets facing dorsal + post.

^{putaxio}
^{1 cew. 1}
 Vertebrae: G 9423, ^{putaxio} G 3437, and atlas G 9437 ^{no?}

dorsal spine
 more posterior than in G.
 { B 3841 (putaxio cew. 10 # 4?) ~~fit~~
 put-zygo. in wide deep V
 B 3945 (like 3841)

and ~~put~~ zygopelvis more anteriorly faced (q. more dorsal)
 closer to V than G. But in V this is cew. 3 (not comb. atlas = 4 is)
 (In G. it is cew. 4 but the ~~put~~ 0

Apele and #1 (G 9423) have post facet parallel
 to axis of the vert., not tipped as in G + V. and post. facet
 of centrum very wide (but not high) + facets post'ly
 rather than upwards as in G + V. q + v also narrower
 and V narrow + high

Dorsal spine in both is broader + stubbier less
 spinous.

In G 3437, ^(= cew. 3) the post zygo. are separated more than in G.
 and are more slender. Cord. is intermed but

cew. 3 + 4 of G. ~~are~~ Ant zygo. parallel +
 facing anterior. Centrum broad, actually flared
 ventrally as in G. #4 which has post zygo widely "V".

In both G 3437 and B 3841 + B 3945 the
 dorsal spine is more post. in this respect more like V
 than G. B 3841 + 3945 have widely forked post zygos.
 and probably rep. G. vert #4, but ~~post~~ ^{ant} facets more ^{+ dorsal} ant.
 in position (closer to V than G)

160
 160.5
 161.5
 20
 34.5
 24
 36.5

Vertebrae: The vertebrae include a single atlas, and what I take to be one cervical no. 1, ~~xxx~~ ^{one} cervical no. 3, and two cervical no. 4. ^{Atlas acutely} The atlas has been briefly described (Howard, 1966: in connection ^{with} the discovery of this element in the material from the Pleistocene of Tequixquiac, Mexico. Comparison of the Mexican bone was made with the condor atlas in the Rancho La Brea collection differing from Gymnogyps and assigned to Breagyps. The characters distinguishing ~~both~~ ^{the} the atlas and cervical no. 1 from either Gymnogyps or Vultur is the parallel position of the articular facets on the postzygapophyses and the broader articulation at the anterior end of the centrum which is directed posteriorly rather than dorsally. In both the modern genera the posterior facets are ~~aligned with~~ ^{at right angles to} the longitudinal axis of the vertebra and the anterior articulation of the centrum faces more dorsally and is narrower. ^{Also} Furthermore, the dorsal spine on both of these vertebrae in Breagyps is broader and stubbier than in the modern genera.

~~The~~ specimen believed to be cervical no. 3 is intermediate in shape between cervicals 3 and 4 of Gymnogyps; the posterior ~~zygapophyses~~ margin between the zygapophyses is more deeply concave than in cervical no. 3, but not as deeply V-shaped as cervical no. 4. In this ^{specimen,} ~~cervical~~ the articular facets parallel position of the anterior ~~zygapophyses~~ reflects the condition already described for the posterior articular facets of cervical no. 1.

The two specimens believed to be cervical no. 4 have the postzygapophyses with a V-shaped space between, as in G and V, but widely separated ~~with a V-shape~~ ^{in a V-shape}. In these two specimens, the anterior articular facets are more antero-dorsal in position ~~and also in cervical no. 3 the dorsal spine is more posterior in position than in G, and more closely resemble V in this respect.~~ than in Gymnogyps, and in this respect more nearly resemble Vultur

^{also} In these two specimens, ~~as well as in~~ ^{as well as in} cervical no. 3, the dorsal spine is more posterior in position than in G, ^{again} ~~more nearly resembling V,~~

Using the vertebral column of *Gymnogyps* as a point of reference, the four ~~remaining~~ ^{remaining} cervical vertebrae appear to represent cervical number ^{3 or 4} 4, cervical number 5 and two specimens of cervical number 6. In the specimen of cervical no. ^a 4, as in the axis, the facets of the postzygapophyses are parallel in position and the posterior articulation of the centrum faces more posteriorly than dorsally. Also, as in the axis, the neural spine is broad and stubby. These characters distinguish the *Breagyps* vertebra from those of both the modern condors.

The specimen ^{identified} considered to be cervical no. 5 ^{has a deep V-shaped posterior margin} is intermediate in shape between ~~cervicals~~ ^{identified} ~~ax~~ 5 and 6 of *Gymnogyps*; the posterior margin between the postzygapophyses is ^{somewhat more} ~~more~~ ^{V-shaped} deeply concave than in *Gymnogyps* and the element is generally less ^{square-sided} square-sided cervical no. 5 but not as deeply V-shaped as in cervical no. 6. In this specimen, the parallel position of the facets of the prezygapophyses reflects the condition already described for the postzygapophyses of ^{the specimen of} cervical no. ^{3 or 4} 4.

The two specimens of cervical no. 6 resemble this element in ~~cervical no. 5 in~~ *Gymnogyps* and *Vultur* in the deep V-shaped posterior contour which separates the postzygapophyses, but the ^{facets of the} prezygapophyses face more ^{anteriorly} ~~anteriorly~~ ^{less and lifted medially} ~~less and lifted medially~~ ^{whereas in G. it is more ant.} ~~whereas in G. it is more ant.~~ The neural spine is ^{ant. post.} ~~approx. centered~~ ^{calit.} ~~approx. centered~~. The ^{specimens at hand} *Vultur* differs from *Gymnogyps* in having only two cervicals between axis and the first vertebra with a V-shaped ~~pos~~ in which the postzyg. are spread apart in a V-shape have a V-shaped ~~to~~ spread.

characters distinguishing Breagyps from Gymnogyps and Vultur in this element are (1) facets of the postzygapophyses parallel, (2) posterior articulation of centrum broad and directed posteriorly rather than dorsally, and (3) neural spine broad and stubby. In both modern genera the facets of the postzygapophyses are aslant of the longitudinal axis of the vertebra, the posterior articulation of the centrum is narrower and faces more dorsally, and the neural spine is more slender.

Using the vertebral column of Gymnogyps as a point of reference, the four remaining cervical vertebrae appear to represent cervical number 4, cervical number 5 and two specimens of cervical number 6. In the specimen of cervical no. 4, as in the axis, the facets of the postzygapophyses are parallel in position and the posterior articulation of the centrum faces more posteriorly than dorsally. Also, as in the axis, the neural spine is broad and stubby. These characters distinguish the Breagyps vertebra from those of both the modern condors.

The specimen considered to be cervical no. 5 is intermediate in shape between cervicals 5 and 6 of Gymnogyps; the posterior margin between the postzygapophyses is more deeply concave than in cervical no. 5 but not as deeply V-shaped as in cervical no. 6. In this respect it more closely resembles no. 5 in Vultur. In this specimen, the parallel position of the facets of the prezygapophyses reflects the condition already described for the postzygapophyses of cervical no. 4.

The two specimens of cervical no. 6 resemble this element in Gymnogyps in the deep V-shaped posterior contour which separates the postzygapophyses, but the prezygapophyses face more anteriorly.

STERNUM

3.24.73

Anterior contour in dorsal view broad and ^{light}stratig^h with lateral borders of dorsal lip of coracoidal sulcus protruding slightly and rather square in outline; dorsal surface of shield ^{deeper}depressed close to anterior border on either side of a narrow central ridge. Carina deep with apex at level of the ~~last~~ costal process, descending abruptly at this point. Vultur and Coragyps are similar in anterior contour but the dorsal depression is less; the anterior contour is narrower and more gradually curved in Sarcoramphus and Gymnogyps.
In and depth
~~The~~ shape/~~of~~ the carina is similar in Vultur but even in this ~~XXXXXX~~
ⁱⁿgenus the apex is further posterior.

Vultur + Coragyps

16.4.73

March 24, 1973

FURCULA

Condorlike in the broad, gradual dorsal curvature of the proximal ends of the clavicles. The arch is narrower and more abrupt in the other three genera, describing almost a 90° angle in Cathartes and Coragyps. Externally, deep pneumatic fossa undercutting dorsal rim as in Gymnogyps, but of less extent ventrally, stopping short of ventral border as in Vultur; ^{however} dorsal rim less undercut in Vultur. Area anterior to scapular tip (externally) with abrupt, shelflike expansion ventrally, narrowed abruptly dorsally with a large foramen between; unlike both Gymnogyps and Vultur, although Gymnogyps shows greater expansion than Vultur, it is gradula with multiple, small foramina, and the dorsal area is less narrowed.

neither + both!

March 24, 1973

SCAPULA

Acromion short and flaring abruptly from shaft then deflected mediad; anteroventrally broadly rounded; coracoidal articulation *low* slightly ~~swelled~~, glenoid facet broad; area between acromion and ^(dorsally) glenoid facet broadly depressed. ~~With~~ the exception of Vultur, none of the other genera have the junction of the acromion with the shaft as abrupt as in Breagyps, but Vultur is immediately distinguished by lesser flare, ~~and~~ no deflection of the acromion and marked anteroventral prominence. In both Vultur and Gymnogyps the space between the acromion and glenoid facet is narrower and less depressed. The degree of flaring of the acromion and the broad depression of the area between the acromion and glenoid facet is closely paralleled in Sarcoramphus; *but the junction with the shaft is abrupt; also* the glenoid facet in the latter genus, however, is narrow. *Sarcoramphus abel*

The ant. border of the two canal is less acute in Vultur but the forsa below the back tub is deeper; the forsa is smaller in *S.* & the ant. border of the two canal is ^{thick}

HUMERUS

Bicipital crest broadly rounded; deltoid crest (anconally) depressed medially with raised evenly contoured border; pectoral attachment broadening gradually from a point proximal to level of distal border of bicipital crest and ending distally near edge of shaft; deep pneumatic depression between internal condyle and attachment of anterior ligament and between external condyle and base of ectepicondylar prominence; ectepicondylar prominence broad ^{anconal} and ~~posterior~~ border slightly concave.

Each of these characters is suggested in one or more of the other cathartid genera, but not in combination. The well-rounded bicipital crest and lateral position of the distal tip of the pectoral attachment are found in Vultur and Sarcoramphus. The gradual flare of the pectoral attachment is also similar in Vultur, but not in Sarcoramphus. The degree of pneumaticity of the distal end is most closely paralleled in Gymnogyps (Vultur has less, Sarcoramphus and Coragyps more). In Gymnogyps ~~there is~~ also the ectepicondylar prominence is similar in size to Breagyps but appears slightly less curved; it is narrower in all other genera, and more curved in Vultur. Although the humerus of Cathartes ^{is least like} ~~differs from~~ Breagyps in general shape and many characters, it is the only one of the ^{living} cathartid genera to resemble Breagyps in the depression and bordering of the deltoid area.

March 24, 1973

ULNA

The *Breagyps* ulna is distinguished from this element in both the living condor genera by greater proximal depression of the brachial impression with large pneumatic foramina, and area between the impression and the internal cotyla swollen. Resemblance is closer to Coragyps and Sarcoramphus in both of these respects. however the olecranon is more blunt than in Sarcoramphus and more distinctly set off from the internal cotyla/^{in lateral contour} than in either of these genera, more closely resembling Gymnogyps in these respects. Distally the external condyle lacks the proximal narrowing found in all the other genera and is more closely appressed to the shaft.

CR + Sar

area.

CARPOMETACARPUS

March 25, 1913
Process M1?

Both proximal and distal symphyses short; proximal symphysis deeply depressed on internal face; prominent tubercle-shaped tuberosity of metacarpal 3; internal trochlear crest narrowing distally, producing uneven, angular contour at junction with shaft, with short ridge distal thereto. Distally, tuberosity of metacarpal 2 short but very prominent, with heavy median and distal borders rimming a depressed area anteriorly. The character of the distal tuberosity of metacarpal 2 distinguishes Breagyps from the other genera, all of which have a longer, less prominent tuberosity. Proximally the tuberosity of metacarpal 3 is also less prominent and more ridelike in the other

over

genera. Sarcoramphys alone resembles Breagyps in having both proximal and distal symphyses short; the proximal symphysis is short in Vultur (though much less depressed than in Breagyps), but the distal is very long and flat. Only Coragyps agrees with Breagyps in the abrupt junction of the trochlear crest with the shaft, but it is dissimilar in the great pneumaticity of the area.

March 24, 1973

PELVIS

Anterior ilia meeting in midline to form long, narrow ridge; dorsal surface of shield moderately convex in midline, perforated laterally with evenly spaced, ~~fairly~~ fairly large pneumatic openings posteriorly, with smaller openings farther forward; posterior ilio-ischiatic surface deep with iliac and ischiatic borders nearly parallel; ^{iliac crests overhang acetabulum;} acetabulum deeply notched on lower internal margin toward anterior edge.

In Vultur the anterior ilia meet in a heavier ridge and for a shorter distance than in Breagyps; in the other genera, the ilia are more widely separated. The condition of the shield is most closely approached in Sarcoramphus, and combines the moderately convex midline of Vultur, with the lateral perforations of Gymnogyps; the perforations are fewer and smaller in Vultur, the midline much more convex in Gymnogyps. The shield is flatter in both Coragyps and Cathartes, ^{larger and} the foramina more numerous. The depth of the ilio-ischiatic surface is somewhat similar in Coragyps but the two crests are not quite as parallel as in Breagyps; ~~the area tapers posteriorly~~ in the other genera ~~with~~ the ~~the~~ downward curvature of the iliac crest, causes the area to taper posteriorly. [↓] The depth of the acetabular notch is not equalled in any of the other genera. Vultur and Sarcoramphus are further distinguished from Breagyps (and the other genera) by the ^{receding of the} ~~absence of protruding~~ iliac crests above the acetabula.

In both Coragyps & Gymnogyps the iliac crest projects over the acetabulum. In Vultur & Sarcoramphus it recedes.

FEMUR

Well flared proximal end narrowing in broad curve to slender shaft; trochanteric crest prominent, markedly deflected mediad and undercut by pneumatic foramina; obturator ridge well defined with deep depression adjacent internally below articular facet; attachment of round ligament (on head) a deep, narrow slit; external intermuscular line forming sharp angle postero-externally at level of distal end of trochanteric crest; in internal profile, distal internal condyle protruding abruptly from shaft anteriorly; ligament attachment above fibular condyle large and facing proximally.

① The proximal flaring is most closely approached in Vultur (the femur is more columnar in the other genera). the trochanteric crest is less deflected in both of the living condors although the arrangement of the foramina is similar in Gymnogyps (there is only one foramen in Vultur); there is some mediad deflection in Sarcoramphus but is more proximally confined and the foramen is single. ③ The prominence of the obturator ridge and adjacent depression is similar in Gymnogyps. the deep narrow slitlike shape of the attachment of the round ligament is distinctive of Brachyotops. The sharp angle of the external intermuscular line is duplicated only in Cathartes. The abrupt anterior contour of the internal condyle is most closely approached in Coragyps.

⑦ The ligament attachment above the fibular condyle is smaller and more posterior in position in all the other genera, the attach of the round ligament more round, less slitlike.

TIBIOTARSUS

TIBIOTARSUS

Shaft straight in lateral profile. External cnemial crest ^{and} with sharply compressed margin ~~and~~ (longer than internal crest) internal cnemial crest extending above proximal articulation and depressed on internal surface;. External condyle (anteriorly) long and narrow ~~xxx~~ with parallel sides and proximal contour blunt and projecting lateral to shaft; ligament attachment above external condyle well developed, somewhat triangular in shape with apex extending to level of upper edge of supratendinal bridge and with small foramen laterally near base; lateral surface of internal condyle thinly margined with small ligament attachment at upper edge.

The shaft in Breagyps is straighter than in all other ^{cathartid} genera. In other characters resemblance is closest to Vultur but in this latter genus the internal cnemial crest has a marked lateral deflection ⁿ not found in Breagyps, and distally the external condyle is shorter and less blunt, the ligament attachment smaller with foramen more proximally placed. Gymnogyps is distinct from Breagyps in all characters described.

Radius - Brachyops May 3, 1973

Distal end B661, prox B6782 (both same side but not same bone)

Distal end flange more abrupt than in ^{either} Gymnops or Vultur
~~and~~ The ulnar depression is deeper than in S. ~~and~~
 and about equal to that in V.

Proximally: ~~ulnar~~ facet capital tubercle slightly
 more prominent than in S, more like V.

Basipit tubercle, ~~is~~ clearly bordered on one more than 21 mm
 below ant. facet with ~~large deep depression above~~
~~+ medial~~, Sub. higher in S. Probably nearer V.
 but depression above (in V) deeper, less rounded

The smaller vultures are quite diff.
 In S, the depression above the basip. tub. is very small

Humerus Brachyops

Head relatively broad + low as compared to S. (but seen palmar view)

The narrow, gradually flared post. attachment
 holds in ~~contact~~ S. as well as a calip. (like V, unlike Cor.)
 (contrast to wider, more abrupt flange in S.)

Broad ^{round} brach. doesn't hold ^{throughout} S. as well as V. The peculiar the
 even rounding of
 dist. edge does
 The rim + depression on deltoid holds in contact with S.

Humerus - Brachyops ant. end. Carina depression on
 either side of central ridge, bordered by lat. ridges as in V. ^{Cor.}
 In S, the lat. part of carina slopes away from ant. side
 without depression
 Vent. marginal spine is ventral ^{+ faces anterodorsally} with a ridge above ridge
 to dorsal edge faces antly in S. ¹ is more prom. Ridge above ridge
 Spine more prom in V + ridge same shape because the spine
 of the spine goes higher (true also of Cor. where very little ridge)

Pelvic 5.3.73

gradual expansion of synsacral caudal area posterior
to acetabulum. B6559, B1635, B1092

This is ^{clearly} true also in Vultur # 1734. In 218 it is not
quite as far back. The ~~iliac~~ ^{iliac} plate & the synsacral

at this point is very pneumatic on its ventral side
reheat below Thus setting off the synsacrum from the ilium
markedly. This is not as marked in Brachyops

also in
Coragyps
the expansion
is part. to acetab.
and synsacrum
is flush with post ilium
vent. surface. In
Gymnogyx the widest expansion of the
synsacral caudal area is in line with the
post. rim of the acetabulum. The synsacrum is
flush with the ventral side of the ilium but is
undercut by a large pneumatic foramen
In Brachyops the synsacrum is flush with
ventral surface of ilium as in Gymnogyx.

In Vultur the post iliac crest slopes downward
very gradually, ^{the crest is straight} providing a higher more parallel-sided
dio inclinate surface at least to a distance of
30 mm back of acetabulum. The downward slope is
more rapid in Gymnogyx & Vultur
In Coragyps the situation is similar to Brachyops

On Brachyops & g. The long, narrow dorsal ridge with closely appressed
ant. ilia is found in some Gymnogyx
(espec. amplus) but in all the ilia step back
to 1st Dorsac. Thence, central ridge of post.
shield is more convex & caudal expansion is more forward
(vent side, see note above)
to reach ^{post} crest does ~~not~~ ^{not} just out over acetab. & oblique dio-inclinate foramen
which is not the case in Vultur

Simulans & Coragyps

Stem Square ant contour ~~but not~~ ~~more~~ ~~sharper~~

Narrow cent. ridge dorsally, ~~but not~~ ~~more~~ ~~sharper~~

(vent lab. prominent like Vulture in Coragyps unlike B.

Pelvis Paraphyses not pneumatic ventrally

Ant ilia extend over thoracics.

Iliac + ischiatic borders nearly parallel

Post ilia ant onchocarpus tubulum

Unlike in gaps bet. ant ilia + flat skull (dorsally)
with large openings - all about same size

Does it have
supracaracal canals?

Carapace: Differs: narrow proc M1, long, max. symplexis
Tub M 3 (max) long + low.

Like: Ant view dist end depressed with int. + dist

raised borders, but ~~for~~ tub. 9 M2 less prominent
dist. hook crest ~~from~~ shaft abruptly

Coracoid Differs: head more flat, hq attach ^{post.} ext, not as ^{on} ~~on~~
neck not so depressed; no marked dng. zone

Like: brachial tub. projects over fossa bordered
by flange + angular edge of two canals

Humerus Differs: bris not rounded, foramen below head less
cap. groove even pneumatic (aural)

Like: Post. attach lateral at dist tip

Distal pneumatic, even greater than B.

Scapula Like: dorsal area broadly ^(but more deeply) depressed by
acromion much more protruded laterally

Ulna - not similar

Ulna - brach. impress not quite as depressed but with
swollen area bet. it + coracoid as in B.

Unlike in straight contour of int. side from coracoid
to olecranon. Dist. more pneumatic with
ext. condyle narrower at top

7 diidans Unliho

Sacromamplum Unlik - narrow rounded
Stem ant contour
no Δ depression in vent. lab. from.

Ths? deep dorsal dep. antly on either side
of central ridge

Incula - NO

Coarctoid NO (no deep fossa, two bader round, no goon)

Scapula broad dorsal depression, similar ant. +
ventral contour, but acromion less abrupt

Humerus Prop ant rounded but less prominently +
less broadly

Post attach dist tip lateral but above mid
abrupt

Unlik; (deep dep below head)

Dist pneumaticity even larger foramin ant'ly.
but none bet. ext cond. + ext ep'.

Cula Even deeper depression of brachial inf but
resembles B in swollen area above
unlik also in less deep ~~dist~~ ^{dist} contour between
ext condyle + olecranon.

Unlik dist, having more narrow tip ext condyle

Carpometacarpal unlik - narrower ^{more toward} base M1 but bulbous tip
[longer less from sub M3], less from ^{longer} M2 tub
higher crest of int tub crest; more pneumatic
join shaft gradually. ~~less~~ ^{thruout}

Pelvis - midline of shield moderately convex + foramin similar
~~best~~

Femur ^{like} F ant crest deflected medially with foramen (1)
Int dist condyle protrudes slightly ant. not quite as abrupt as B
unlik - no depression adj to dist ridge
large rd lig. attach.

Sar.

T. diotaris NO

Cathartes *sternum - Depressed Δ on vent. labial prominence
but deep pinnate in sternal impression

Incubator NO

Scap. dNO

coracoid has fossa ext. but brach. tub. does not protrude over it

Ulna - very ptd head & furca, fact

Humerus NO except depressed deltoideus crest with heavy border, gradual pectoral scar but ends medially. Very faint depression below head of humerus. Deltoideus more flared humerus

Carpus - Prominent tub M2 dist but longer ant. def. with dist border also

Ulna - ~~short~~ long prox symphysis very projected prox M1, small tub M3

Ulna - angular take No of ext. condylar line but nothing else

Tibia NO.

Skull

- ★ { Breadth of shield + anterior contour - 1 Vultur + Coragyps 1
2 " " 2
Shape of carina 2 " " 2
Ventral labial prominence (vent. surface) Gymnogyps 1 + Cathartes 1

Scapula

Dorsal area broadly depressed - Coragyps 3, Sarcophaga 1

Coracoid

- ★ Proch. tubercle protruding over fossa - Coragyps 4, Vultur 3
+ fossa bounded by angular edge of
two canals

Humerus

- ★ Broadly rounded bicapital crest - Vultur 1
+ small deep below crest
Tip of pectoral attachment lateral - Vultur 5, Sarc. Coragyps 5
Depressed deltoid + raised margin (but more flared) - Cathartes

Ulna

Swollen area between rach. inf. + stylo - Coragyps 6, Sarc. 2

Carpometacarpus

Internal trabecular crest joining shaft abruptly - Coragyps 7

Pelvis

- ★ Parapophyses not pneumatic ventrally - Coragyps 8, Vultur 6
Iliac + ischiatic borders nearly parallel - Coragyps 9
+ post. iliac crest overhangs acetabulum - Gymnogyps 2, Coragyps 2
Convexity of shield - Vultur 7

Femur

Rach. crest deflected medially
Internal distal condyle slightly angular antly } Sarc. 3/4
Well flared proximal - Vultur 8

Iliofemoral

- ★ Length of enseminal crests - 9 Vultur
Extent of " " above art. 10 Vultur

The foregoing description is presented, ^{primarily} as a means of identifying the ^{skeletal} elements of Breagys, ~~it is not intended~~ although

Most distinctive chars. of Breagys
Sternum Position of apex of carina (more ant.) otherwise general shape like Vultur + Cratys

Scapula ① Deep pneumatic fossa undercutting dorsal run of clavicle but ending above ventral border
② abrupt expansion back of scapular tip, with foramen

Scapula - Short abruptly flared acromion with marked med. def.

Coracoid - Uneven contour of head with marked diagonal groove through furcular facet
Otherwise (brach. tub + fossa) like Vultur + Cratys

Humerus - Depression of deltoid crest with heavy even border (shared only with Cathartes which differs in all other respects)

Otherwise similar prox'ly to Vultur
paula dist'ly to Gymnops

Ulna - Short, heavy ext condyle

Carp. - Short, prom. tub M2

Pelvis - Combination of the two
closely appressed ant ilia in long ridge

crest
narrow
in B.

Deltoid crest is narrow in Bregma
widest in Cath + Cor. - width provides better depression
+ elevation of rotation of wing
(Associated with a longer arm, makes easier the
raising of ant. edge of wing to increase angle of incidence"
Luthe P. 569

Pneumatization is greatest throughout the skeleton in
Gym. + Cath. + is associated with greater soaring

Luthe
P. 568
- 569

least flappier.

No data on flapping ability of Vultur + Sarc. But
Coragyps which has heavier skeleton than Cath + Gymnops
flaps more than these 2 sps

Bregma
not very
pneumatized

sternum
heavy in B.

But light sternum of Cath may account for its costly
soaring.

"Greater wt of shel. in Vultur is striking" Luthe P. 568

Sternal keel - highest in flappers

Luthe
P. 570

highest in Cathartes

Cor. + Sar higher than V + G

Apex of carina (positioning)

Pointing forward better flapper

Depth of dorsal trough greatest in flappers

Cath + Cor. do not have a deeper trough than other ^{Cath} _{acted}

Luthe P. 570

Coracoid length strength + rigidity of fixures best in soarers
longest in Cath, Gym. + Sar.

Luthe
P. 571

Wing length based on bone only is not very conclusive
need rel. length to body weight which shows Q. shortest!

Cath longest rel. to wt.

Even wing length to humerus length + interaction with
not conclusive

Really need feathers.

Compare wing bone length (width) to humerus shorter than humerus in accip. & Coragyps
" slightly longer " " " Bates, Sar, Vol. 1)

greater humeral length " $\frac{1}{2}$ longer " " " J. & Cath
B shorter hum. than G (or V?)
Ulna length does not sep. groups clearly

Possibly the shorter forearm in flappers
short ulna in accip.

B longer ulna

" " in Cor.

less " in S. & V. than Cath & J.

Inter p. 573

Ulna has increased in length in all Cathartids
(as compared to hawks) but increase is least
apparent in Cor. & most notable in Cath.

Metacarpus rel. to humerus length greatest in accipiters
longest in Cath, shortest in accipiters & Cor.
less increase in J. than Cath.

B longer metacarp

Note long wings of Cath, result of lengthening all parts of wing
but accentuated in metacarp & phalanges

In J. & V., long wing produced by more equal
increase in length of each segment. Again
greatest increase is distally but rel. less than
other Cathartid genera.

Coragyps shows least lengthening of wing bones.
Most is distal, esp. digits. all ratios
except digits close to alula & accip.

Pres. has rel. longer cor. / humeral length
" " ulna " "
" " carp " "
" same length hum " "
" shorter hum. to cor. length
" longer ulna " "
" same length carp " " "

Humerus

Brea Bicipital crest relative short, proximo-distally but broadly & evenly rounded, protuber. noticeably internal to int. tuberos.

Vult. Crest longer & less protuber. (the evenly rounded)

Gym. Short & more straight side, rather angular as it joins shaft.

Brea Deltoid crest ^{with} heavy rim ~~set~~ set off from depressed area medially

Vul. No definite rim & less depression

Gym. " " " " " " " " " " " "

Brea Postoral attach widens gradually from pt prox to level of bicipital crest with shaft. Medial contour evenly convex receding to tip at ext. edge of shaft

Vul. Generally similar the widening starts more distally.

Gym. Widens very slightly just below ^{distal edge of} bicip. contour then widens abruptly medially before receding in straight line to tip which is set medially of ext. edge of shaft

Brea Dist. Well excavated ext to ext condyle, ~~between~~ ^{between} around by attach int'l by & bet. lig. attach & int. condyle.

Vul. Less deeply excavated

Gym. (same like Brea., others less excavated)

Brea Epitrochlear prominence (lateral view) curved (convex palmar contour, ^{marked} concave anterior contour

Vul. Similar but prox tip protrudes laterally

Gym. palmar contour convex but antecubital straight

Pneapys vs. Vultur cont'd

(2)

Brea Proximal flared, shape narrowed

Vul " " "

Gym. slender throughout

Brea trach crest prominent + well deflected mediad

Vul less deflected

Gym " " "

Brea albedi round lig, ^{long} deep, narrow slit-like ~~extending~~

Vul deep pit set ~~back~~ ^{well} mediad of int surface

Brea lig albedi above fibular condyle large flat + rugose
facies prox.

Vultur small, rugose, facies postl

Gym small, depressed, facies postl

Brea Obturator ridg sharply defined int'lly with depression
adjacent + under iliac fossa

Coracoid

Brea uneven development of head, with diag. depression

Vul Even head

No " "

Brea Brach. tub protuberant

Vul " " "

more with flange ext. ndg

projects beyond edge of tub covers

Gym. " tub " less

Brea lig. attach on ext side of head short + deep + abutted ^{containing}

Vul " " " longer + narrower but also " " ^{ext}

Gym " " " " " + smooth contours

Scapula

Brea Acromion short + abruptly, set off from shaft
 + deflected mediad on dorsal surface

Vul. Acromion longer, less abrupt from shaft, No med. deflection

Brea ventral small projection under prox tip of acromion

Vul " large " " " " " "

Gym. proc. less more proxly than Brea about same number

Carpometa

Brea Slender thin prox symphysis + ^{deep groove} ~~well depressed~~

Vul. Heavier & less depressed

Brea Ext crest of troch. connects abruptly

Vul. " " " " " " Gradually

Brea Mz dist. short + ^{probably convexly} ~~runned out~~ + distal

Vul " " long + slightly edged
 less marked rim

Gym. even less " " " " " " More Vul
 also long + not per.

Lunula

Brea Lower flattened out ventrally

Vu. Same but not as in flattened as Brea above

Gym. Inflated to ventral contour

Brea Tub with foramen above at scap tip more flattened tip

Vul. No tub. sev. small foramen

Gym. " " " " " "

Breagys - ext. condyle ^{extremities} ^{near prox tip}

Sar. vs. Breagys

Humerus similar in Sar. in well rounded bicipital crest + lateral position of scapula

But more depressed + pneumatic area below head palmar in S., more abrupt contour of pect. attach. + no heavy rim of deltoid crest (anomaly)

Dist end in Sar has large ^{round} pneumatic foramen between int cond. + ~~lig. surface~~ ^{attach} ant. art. lig. + no ^{deep} pneumatic bet. ext cond. + olecranon from. Ectepi narrow

Cath vs Breagys

Humerus with squared off bicip. crest, scapula medius Thus dif from Breagys. Less from. + abrupt position of int side of dist. end. Ectepi cond. from smaller. Apex of delt. crest more dist. Ectepi straighter int cond. narrow (flatter above)

Similar to Breagys in heavy border around depressed deltoid, gradual flare of surf. for muscle attach. (pect.) faint depression below head palmar

Vul. vs. Breagys

Humerus - straighter shaft in Vulture. Deltoid crest not as depressed anomaly or evenly bordered, apex of pect crest more distal in V. Deltoid less flared. Less pneumatic distally

Vul. similar to B in rounded bicipital crest but crest longer + not as prom. laterally. V. Pectoral attachment gradual + teardrop laterally B depression below head small as in B. Ectepi from ^{even more} curved ancon. but narrower + more lat. protrusion. Gym. vs B.

Pect. crest less flared no heavy border to deltoid abrupt surf. pect attach teardrop medius. Bicip. less from. less distinct curved anterior edge of ectepi an. from.

Ceragys vs B

Pect. crest more flared noticeably broader apex more dist. Ectepi ^{very} narrow. Pouch imp. very pneumatic. Dist below head deep + teardrop lat. as in B. Ridge ancon. sharper. Dist condyle ^{round}

Bicip crest
B vs Cath
B has narrow ectepi

Tenon

Varied ant'ly - Well flared prox end narrower in ~~lateral curve~~ slender shaft. Closest to V. tho even here the ~~various~~ flaring is less marked. Others are even more columnar.

Trochanteric crest prominent markedly deflected mediad (ant'ly) + ~~base~~ ^{undercut} anterior by pneumatic foramen. Less deflection in V. + only one foramen not undercut.

Less deflected also in G. but foramina closer in char to B. →

Obturator ridge well defined with depression int + below facet. Seen in G. V more broadly rounded with less marked deflection. Less well defined in all others. Some mediad deflection in Sac. but only ^{more} prox. + foramen ridge.

Distally int contour of int. condyle - condyle protrudes abruptly from shaft. More gradually connection in V + G. Somewhat like Cr. ~~lower in~~ Sac.)

By attach over fib condyle large + facing med. (Smallest part in V + G.)

(very small prom. + post pit with heavy rim in latter)

Ext intermuscular line forms sharp angle on posterior edge of ~~shaft~~ ^{on shaft} at level of dist end of fresh crest before ~~crest~~ ^{proceeds distally on} ext. side of shaft + ~~proceeds distally~~

On Both G + V line is sharp + looks angle

Braegyrus	Gymnocyphus	Valtun	Coarctoid Cratops	Cathartes	Sarknaphus
angular int. border trio. canal	rounded	angular	very angular	rounded (but less than G)	moderately angular
pneumatic fossa below head internally	no deep fossa	fossa much deeper	fossa present	fossa present	fossa present
oblique depression in face & facet no facet but hi & low parts	evenly rounded	evenly rounded	tendency to oblique depression	even contours & pointed	tendency to oblique depression but no hi-low parts
lower margin face, facet concave with slight projection	straight no projection	margin well marked & projecting	projecting but facet much narrower & greater X depression below	no overhang of facula facet	edge of facet well marked & projectal but facet thinner X

shaft curved	Gymnocyphus	Valtun	Coarctoid	Cratops	Cathartes	Sarknaphus
shaft curved	even	shaft	even	even	even	curved
Preapical broadly curved rounded	irregularly contoured less broad	rounded contour	square contour	square contour	square contour	rounded contour
quadrate at edge	median portion	near edge	near edge	median portion	near edge	near edge
almost no depression below head (helium)	well defined	slight	more impressed	slight	more impressed	more impressed
dist pneumatic depression	int OR ext?	ext OR? int NO	dist pneumatic depression	dist pneumatic depression less	no pneumatic depression	no pneumatic depression
rectus attaches	broadens	broadens	broadens	broadens	broadens	broadens
curves gradually	abruptly	gradually but begins dist. to beipeds	abruptly	abruptly	abruptly	abruptly
begins prox to bipeds	straight but narrower	narrow & curved	high & slender but not much curved	more slender than Braegyrus	broad with slight curvature	Check this again for all sps

Scap					
Buapys	Gymnaps	Vultur	Corapys	Sarcophila	Cathartes
acromion	acromion	acromion	short & from	less abrupt	short not
rostr. abruptly	not gradually	not <u>drifted</u>	short	rise	prominent
deflected	less deflected	less deflected	very deflected	less deflected	very deflected
medial	medial	medial	medial	(close to	
			Corapys	Gymnaps	
area between	less depressed	slightly	depressed		apert. small
acromion &		depressed	with pneumatic		X glenoid
glenoid			on joint		facet joints
well depressed					abruptly

Scap cont'd

prox contour					
straight					
coracoid	more convex	coracoid			
artic flat	ball like	flat?			
ant contour	more arched	even more	more from		
of acrom	produced antly	ant'ly produced	prox. than		
broadly rounded	(prominent	(prominent	Buapys		
lack of prom.	tubercle)	tubercle)			
ant. vent tubercle	ventrally	ventrally			
short broad	q. narrow	Vultur	Uva	Cathartes	Sarcophila
ext. tubercle	T longer	Narrow	Corapys	narrow	narrow
appressed	prox. dist	more	narrow	close	more pneumatic
		pneumatic	high	appressed	set off
		set off	more	to shaft	
			pneumatic		
			set off		
prox	only moderate	moderate	close to	moderate	close to
brachycephalus	depression	depression	Brachy	depression	Brachy
deep &	no heavy	no heavy	cond. but	no heavy	but
pneumatic	prox body	border	more	border	more
T well	blends into	blends	pneumatic	blends to	pneumatic
sep from coryla	coryla	to coryla		coryla	

Gymnognathus tibetanus less sharply
compressed ext. crest & generally shorter
Dnt crest depressed on int surface as in B, also extends
above articulation

	Gym	Vul.	Cor
B prox art	35.9 x 30.1	35.1 x 28.4	20.4 x 16.3
35.5 x 29.5	34.5 x 29	37.4 - 29.2	18.8 x 15.8
37.5 x 29	33.3 x 28.8	81.1%	80.9%
35.2 x 29.8	83.7%	78.3%	84.2%
35.5 x 28.8	84.2%		84.2%
83.3%	86.5%		
77.4			
83.4%			
81.3%			

Ceromyx ext crest less appressed than B + shorter
more? 1111

Vulva
Cor. distally - bridge higher

Gym. distally attach above ext condyle, ^{smaller} less rugose
~~I for *Gym.* above (not lateral) ^{it}~~
Cor. ext cond parallel to shaft not ext. directed
Vulva ext cond goes off to side at prox part
B1593 may be *Gym.*

Preapoph.
~~short~~ pro-symph.,
+ deep, channeled

distal symphysis
short

M1 process
broad

int margin int.
tooth crest narrow
abruptly distally

Tub. q12
★ short + prominent
depressed antly
also, preto

Distal contour
M3

Symnophysis
long
less depressed

short

evenly
rounded

Tub. long
and large
no ant
depression

variable

Calymenacarpus

Pulver
short
less depressed

long + flat

shorter +
more forward

evenly
rounded

tub. long
but depressed
ast to it

Cratoph.
long

short

asymmetric
narrow

very narrow
abrupt constrict

long +
straight

angular
(~~angular~~)
M3

Calth.
very long.

long
symphysis

evenly
rounded

ridge

Sarcophagus

short

Short

more straight forward
+ blunt

gradual curve

ridge

ilia to ant border
sacrum

ant iliac area
high & narrow

Transverse process
of synsac. Thracis
non pneumatic

Shield, only
slightly convex medially

Gymnagys
backd ant
tip of sacrum

convex

pneumatic

very convex

Pelvis
Vulturnis
close to
Bregma

meet in
heavy ridge
for short distance

pneumatic

well rounded
but broader
than gym.

Cragyns
still more
ant.

touch at
one pt.
only

more like
Bregma

flat

Caltharke
still more
ant

flat

Sarcnaipes
variable, like
Bregma, 1 more ant.
ant. tra separate

close to Bregma



page size 150mm x 213 mm Bulletin
 " " 110 " 165 Contrib.

Postcranial elements of the extinct condor

Brachyops darwini (Müller)

by Hildegard Harlow

Would take
 24? pages Contrib.
 18? " Bulletin
 including tables
 and figures

17 ms pages

10 tables (9 columns across by 6 vertical (four of this size) } plus
 9 " " " 14 " (one " ") headings
 9 " " " 3 " (two " ")
 9 " " " 7 " (three " ")

Views Illustrations to include photographs of the following elements

- 1 Sternum (lateral view) 140 x 82 mm
- 2 Coracoid (two views) 110 mm x 50 + 110 x 25
- 1 Scapula (one view) 115 mm x 30
- 1 Furcula (one view of left clavicle) 77 x 62 mm
- 3 Humerus (two views proximal end, one view distal end) 141 mm x 60, 147 mm x 48
- 1 Carpometacarpus (one view) 150 mm x 35
- 2 Ulna (one view proximal end, one view distal end) 131 mm, 128 mm [No complete ulna available]
- 2 Radius (" " " " " " " " [No complete radius available]
- 3 (or 2) Pelvis (three views? [Could cut this to two]) 182 x 90 mm (actually 175)
- 2 Femur (two views) 148 mm x 40
- 2 Tibiotarsus (two views) 225 mm long (reduce to 180 mm) $\times \frac{4}{5}$

Bulletin Would take 7 or 8 plates, at least 3 of which would be full page
 Contrib " " 8 or 9 " probably all full page
 Two bones would have to be reduced in size for either Bulletin or Contrib.

Legends for figures

Include reference to 19402 carponeta. having
been figured by Miller as C. granulosus (M 1925) later

1925
pl. 5, fig C

assigned to B. clarki (M. & H 1938: 169 and 170)

carponetacanthus 19402 internal view (see Howard & Miller
1938: 169 and 170)

R Y

Method page 1

Research Associate in Avian Paleontology

Besides its occurrence at RLB B. clarki
has been recorded on the basis of fragmentary material
from Smith Creek Cave Nevada (Howard 1935: 206) and from Tepic, Mexico
(Howard, 1971: axis vertebra)

Breaky p 58 + 32? + 34 + 22 in Smith Creek look at
Hemal 1952: 53 (vertebrae) vertebrae from Smith Creek

The Preliminary avifauna of SCC Nevada, with a description of a
new gigantic raptor. Bull. So Calif Acad Sci. 51(2): 50-54

Sept 1

Deft
mex.

mid
bre

depth
width

67
Depth sheet
at end

May, 148.4 } = 137.45 M
 min - 126.5

✓ ✓ Rabio
gb ba ba de la ga

B570	130.4	26.8	24.7	11.4	18.7	12.2	10.4	89.0	9.3	20.4	61.0	87.5	8.1
B309	133.6	28.0	24.9	11.8	19.2	13.2	11.4	88.4	9.9	20.9	61.5	88.5	8.5
B417	129.4	28.2	24.6	12.0	19.3	14.1	10.9	76.6	10.9	21.7	62.2	92.7	8.3
B140	137.3	30.3	27.6	12.8	19.9	13.0	12.7	97.7	9.4	22.0	64.4	93.0	9.2
B450	132.6	29.4	25.8	12.0	19.1	12.2	10.7	87.8	9.2	22.1	63.9	90.6	8.0
B3	139.4	28.6	25.7	12.4	18.7	12.6	11.2	89.0	9.0	20.5	66.3	89.0	8.0
B1203	131.9	31.4	26.8	13.1	19.8	14.2	11.7	82.5	10.7	24.8	66.1	100.0	8.8
B560	143.2	30.5	27.2	12.7	20.4	13.3	11.8	88.7	9.2	21.2	62.3	88.6	8.2
B7646	135.1	28.3	24.9	11.9	19.7	13.3	11.0	82.7	9.8	20.9	60.5	88.1	8.1
B5809	124.5	28.5	26.5	12.3	19.7	13.0	11.4	84.5	10.0	21.2	62.4	91.5	8.4
B8238	144.6	31.0	27.3	13.0	20.0	13.7	12.3	89.9	9.4	21.4	65.0	90.0	8.5
B1359	126.5	29.7	27.9	12.3	19.7	14.2	12.4	87.3	11.2	23.4	62.5	97.4	9.8
B8375	138.5	28.6	26.7	11.9	19.5	13.8	11.6	84.1	9.9	20.6	61.0	86.0	8.3
B515	129.9	27.9	25.7	11.7	19.0	13.7	11.1	81.1	10.5	21.4	61.5	90.3	8.0
B351	142.3	31.7	27.0	13.1	20.5	14.7	16.4	77.6	10.3	22.2	64.0	92.0	8.0
B196	135.0	29.7	25.2	12.4	18.4	14.1	11.3	80.2	10.4	22.0	67.4	92.0	8.3
B1249	146.9	32.4	—	13.0	20.3	15.9	12.9	81.3	10.8	22.0	64.1	88.5	8.7
B249	144.3	29.4	—	12.6	20.5	13.5	11.3	83.7	9.3	20.3	61.5	87.3	7.8
B292	139.1	31.9	25.6	13.2	20.3	13.8	11.4	82.6	9.9	22.9	65.0	94.8	8.2
B74	148.4	31.0	29.2	13.5	21.3	14.3	12.3	85.9	9.6	20.8	63.3	91.0	8.2
B506	141.5	30.0	27.0	12.5	20.2	15.6	12.2	78.3	11.0	21.2	61.8	88.3	8.6
B6491	138.5	30.1	26.9	12.4	20.0	15.2	12.1	79.6	10.9	21.7	62.0	89.5	8.7
B1331	137.5	29.3	26.0	12.3	19.0	13.4	11.3	84.4	9.7	21.3	64.7	89.5	8.2
B8192	133.6	30.3	26.3	12.1	19.3	14.1	11.5	81.6	10.5	22.6	64.3	93.0	8.4
B325	142.4	30.1	25.0	12.3	20.4	13.7	11.4	83.3	9.6	21.1	60.3	86.4	8.0
2 134.6.4													
2572584													
194													
gac.	131.4	27.7	25.0	11.6	19.1	11.2	11.2	100.0	8.5	21.0	60.7	88.3	8.5

1933														
Airsus														
Length	Bred.	9	deft	9P	Brd.	9	deft	9a	9b	cb	da	ed	h. def	Ratio
B8168	125.6	12.7	25.9	10.8	21.9	85.1	28.9	11.21	38.6	21.4	81.5	23.0	73.7	65.6
B8563	117.5	13.1	26.3	10.8	20.1	82.5	29.5	11.12	0.69	12.23	76.6	25.1	69.9	69.5
B8247	116.8	12.3	26.8	10.8	20.0	87.9	29.1	10.5	19.5	19.22	77.0	24.9	67.0	70.7
J9932	121.0	13.1	26.5	9.7	20.5	14.0	30.0	10.8	20.4	80.21	77.3	24.8	68.0	69.4
B3285	114.9	12.7	25.7	10.0	21.4	78.9	29.1	11.0	21.2	87.22	83.4	25.3	73.0	68.8
B6930	112.6	13.2	25.7	10.4	20.4	78.3	29.3	11.8	20.2	9.22	79.5	26.0	69.0	72.3
B8325	118.6	12.1	20.9	20.9	29.3	21.4	22.3	78.8	24.7	73.17	11.5	17.6	65.3	39.3
B5658	117.6	13.7	27.0	10.3	22.4	73.2	29.1	11.4	21.4	87.22	88.0	24.7	73.6	65.4
B8311	115.9	12.1	26.7	10.5	20.9	86.8	30.3	10.4	20.9	80.23	78.3	26.1	69.0	69.7
B8323	119.9	12.7	26.6	10.4	21.3	82.0	29.9	10.6	21.0	86.22	80.2	25.0	70.3	67.3
B8317	113.1	13.0	26.0	10.4	20.7	80.0	29.3	11.4	19.8	9.12	79.6	25.8	67.6	67.6
B326	118.0	13.2	27.0	10.6	20.7	79.7	30.1	11.2	22.1	89.23	76.7	25.4	73.4	66.5
B1908	110.7	12.0	26.0	11.2	20.2	9.0	28.6	10.4	9.9	32.1.6	77.7	23.7	69.6	63.5
B1697	120.5	12.3	26.0	11.2	20.2	9.0	28.6	10.4	9.9	32.1.6	77.7	23.7	69.6	63.5
B1908	110.4	12.1	25.3	11.4	20.6	28.4	19.5	10.9	8.9	22.4	79.2	25.3	68.2	68.1
B7060	125.7	14.4	20.6	28.4	19.5	31.3	21.4	11.2	17.5	18.4	11.2	17.5	18.4	10.2
B1996	119.7	12.7	27.0	9.1	20.4	88.3	24.4	12.7	20.1	17.6	22.6	75.5	26.1	62.0
B2533	121.3	11.5	27.2	10.3	20.2	66.6	3.7	12.7	21.7	78.4	22.4	74.3	22.7	64.5
B2423	120.2	13.4	26.3	9.6	18.9	86.3	24.6	11.2	19.9	77.22	72.0	25.4	66.5	11.8
B4731	122.7	14.9	27.4	8.0	20.0	59.0	32.7	12.1	21.3	7.12	73.0	26.6	65.3	12.0
218	121.3	13.0	27.2	9.5	21.3	73.1	31.0	10.3	21.3	7.52	78.3	24.7	68.6	12.6
218	121.1	12.7	27.2	21.4	31.0	21.2	21.7	18.7	24.7	68.4	12.0	16.9	71.0	38.7
737	94.2	19.3	14.0	23.4	14.3	20.5	12.5	24.5	61.8	8.6	11.4	75.3	37.2	49.3
141	113.3	26.0	19.7	28.5	20.6	31.0	19.0	12.4	48.1	10.5	8.4	25.4	73.2	37.8
4) 4579	114.5	11.6	64.0	4.487	2.7	22.5	73.7	26.9	64.2	4) 2934	4) 1497	4) 2047	73.2	37.8
B3670	109.9	12.9	25.4	9.1	31.0	19.9	11.4	17.1	12.8	17.4	120.2	8) 961.6		

	Fossil	Taurus	Gymnos.	Ulfen
Length	110.4 - 125.7 ()	110.4 - 125.7 ()	119.7 - 122.7 ()	125.3
Breadth ^o prox.	25.7 - 27.0 ()	26.3 - 27.4 ()		27.2
Depth ^o prox.	20.1 - 21.9 ()	18.9 - 20.4 ()		21.4
Breadth ^o dist.	28.6 - 30.3 ()	30.6 - 33.7 ()		31.0
Depth ^o dist.	19.5 - 22.1 ()	19.9 - 21.7 ()		21.3
Breadth ^P shaft	12.1 - 13.7 ()	13.6 - 15.5 (14.8)		13.0
Depth ^q shaft	9.7 - 11.2 ()	9.1 - 10.3 ()		9.5
Breadth ^x condyle	11.3 - 12.4 (11.8)	11.8 - 12.4 ()		12.1
Depth ^y condyle	16.4 - 18.3 ()	15.9 - 16.9 ()		16.9
Ratio ba	21.4 - 23.7 (22.4)	22.3 - 22.8 (22.5)		21.7
Ratio cb	76.6 - 83.4 (79.2) ✓	72.0 - 75.5 (73.7)		78.5 ✓
Ratio da	23.0 - 26.1 (23.3)	25.4 - 27.7 (26.9)		24.7
Ratio ed	67.6 - 73.7 (68.2) ✓	62.0 - 65.3 (64.2)		68.5 ✓
Ratio xy	63.5 - 72.3 (68.1)	71.5 - 76.7 (73.2)		71.4
Ratio xd	38.9 - 41.6 (40.2) ✓	36.7 - 38.6 (37.8)		39.0
Ratio yd	56.4 - 63.4 (59.2) ✓	49.1 - 53.9 (51.1)		54.6
Ratio qp	74.0 - 91.0 (81.8) ✓	59.0 - 70.6 (64.0)		73.1
Ratio pa	10.1 - 11.8 (10.9)	11.2 - 12.7 (12.1)		10.3
Ratio qa	8.0 - 9.3 (8.9)	7.1 - 8.4 (7.7)		7.5

Vultur clarki

Conder
1933 Notes

Chauvin

	a vent. length	b Breath	c dorsal length	d ht.	e leat. breadth	8a
clarki						
K 3158	62.3	57.6	83.3	48.8	31	92.5'
B 2148	64.0	57.2	80.9	48.0	29.2	87.2
corax						
Bi 716	35.6	37.2	51.1	20.0	21.4	104.0
Bi 228	36.7	39.4	54.3	28.4	23.5	107.0
pyrrhus						
218	61.7	47.2	79.3	46.7	30.5	76.4
cathartes						
Bi 18	34.3	35.7	51.7	20.1	20.0	104.0
pyrrhus						
B 5415	66.0	48.6	84.9	47.4	28.5	73.6
B 5414	67.6	49.9	86.8	48.2	29.0	73.8
papa						
686	46.0	48.3	64.5	40.3	27.3	105.4
737	44.7	49.7	60.8	41.2	26.6	111.1

	Length	breath	Beak	max ext	max int	Depth	
K 3158	122.3	23.3	25.0	54.6	54.1	15.1	16.3
J 9091	112.3	22	23	47.2	48.6	14.6	—
Bi 716	65.0	17	12.4	26.7	27.0	7.6	6.8
Bi 228	62.0	17.4	13.7	26.6	23.8	8.2	7.6
218	93.0	23.3	23.3	27.6	23.1	15.3	15.7
Bi 18				28.0	34.5		
pyrrhus				27.6	33.0		
B 3867							

List of Paedagys specimens

40

B1400's

- B1428 sternum in mt.
 B1495 R coracoid in mt.
 B1499 L coracoid.
 B1437 L dist end femur.
 B1404 L femur.

B1500's

- B1517 - sternum ^{manubrium only}
 B1574 - R dist end femur.
 B1593 - L dist end tibia.
 B1583 - R prox ^{frag} humerus.

B1700's

- B1739 R coracoid (illus).
 B1755 R carpometa.

B1900's

- B1910 L prox end ulna.

B1000's

- B1074 - L tibia tarsus ^{dist}.
 B1082 - nearly complete pelvis. (broken ^{on} left side)
 B1075 - L carpometa tarsus.
 B1092 - L frag. pelvis (acetab + post ilium)
 belongs with 1082

B1600's

- B1670 - R scapula.
 B1657 - R scapula.
 B1674 - R scapula.
 B1638 - L coracoid.
 B1671 - L scapula.
 B1635 - mid portion pelvis. + complete sacrum
 B1665 - part ulna in mt.

B1800's

- B1859 L prox end ulna.

B2000's

- B2224 furcula (what part?) L clavicle
 " " " " R clavicle
 B2601
 B2259 L scapula.
 B2311 R coracoid.
 B2314 ⁹ R prox tibia.
 B2644 L coracoid.
 B2083 L prox humerus.
 B2156 L ^{frag} prox humerus.
 B2034 R dist humerus.
 B2667 R carpometa in mt.
 B2168 R carpometa.
 B2116 L dist tibia.
 B2632 L carpometa.
 B2115 L prox tibia.
 B2181 L carpometa in mt.
 B2599 R femur. (no prox)
 B2267 R prox femur.

12
 28
 40 This page

1117 hum. prox ~~dist~~ comp. 1117
 1118
 1119

B 3000's

- B 3071 Sternum manub., ^{no costals} ^{carina length} mt. other one?
- B 3246 - R humerus in mt.
- B 3242 - L coracoid.
- B 3372 Sternum manub., L costals, part of costals, carina
- B 3420 R scapula
- ~~B 3554~~ = B 4554
- B 3482 L scapula.
- B 3783 Sternum carina, manub. (no costals)
- B 3424 R coracoid.
- B 3453 L dist. end ulna.
- B 3821 L coracoid.
- B 3838 R ulna (prox.).
- B 3625 R carponeta.
- B 3154 L carponeta.
- B 3576 R femur (in mt.).
- B 3379 L femur in mt.
- B 3358 L femur.
- B 3388 R dist. end femur.
- B 3672 L prox. " "
- B 3361 R prox. tibia.
- B 3383 R dist. tibia.
- B 3271 R carponeta.
- B 3553 dist. ulna
- ~~B 3149~~
- B 3149 R dist. carponeta.
- B 3346 Sacrum + ant. pelvis (no acetabulae)

B 4000's

- B 4221 R ulna prox.
- B 4418 L scapula.
- B 4450 R scapula (illus).
- B 4630 R ulna (prox).
- B 4862 R scapula in mt.
- B 4847 R dist. humerus (illus).
- B 4160 L carponeta.
- B 4375 L carponeta.
- B 4954 R prox. humerus.
- B 4458 - prox. ulna in mt.
- B 4989 R femur.
- B 4039 R tibia.
- B 4912 nearly complete pelvis in mt.
- ~~B 4039 R tibia~~ dup.
- B 4554 manubrium L costal row

B 500's

- B 5329 R prox. humerus (illus).
- B 5669 Sternum best specimen ^{to be put in} ^{R costal 1/2}
- B 5917 Left prox. ^{frag} humerus.
- B 5956 R dist. humerus.
- B 5331 R carponeta.
- B 5580 L femur (photo).
- B 5873 L femur.
- B 5693 L femur.
- B 5950 R dist. femur.
- B 5878 R tibia (illus).
- B 5156 R dist. tibia.
- B 5165 frag. of pelvis in mt.?
- B 5891 R dist. ulna.

$$\begin{array}{r} 23 \\ + 27 \\ \hline 50 \text{ two page} \end{array}$$

50
49
40
139
#76
145

B6865 R frag pelvis
with acetab.

P.3

24750
+ 5/6
5/6

B6000b

- B6020 L scapula
B6035 incomplete furcula symphysis ✓
B6188 R coracoid
B6859 post part pelvis + sacrum L side
B6332 L scapula
B6320 R coracoid
B6372 prox femur
B6318 L prox humerus gymmuregus?
B6865 bas pelvis
B6712 R carponda
B6782 distal radius
B6395 L carponda
B6912 L prox ulna
B6910 R femur Cno proxi
B6477 R dist femur
B6259 L femur
B6914 L dist ulna
B6620 R dist femur

B6938 - L shaft femur (part) dist.

B6Y137 B6414 - prox dist femur Tibia

B6404 - R prox femur

B6925 - L prox ulna

B7000b - Tibia

B7069 L coracoid
B7558 L scapula in mt.

B7085 R dist femur

B7124 R coracoid

B7479 L coracoid

B7699 R coracoid

B7743 L coracoid

B7847 R coracoid

B7244 L dist femur

B7914 L coracoid

B7951 L shaft femur (broken shaft in mid)

B7737 R humerus

B7895 sacrum + pelvis

B7730 L humerus complete

B7248 R prox ulna

B7247 R humerus lacking prox end

B7503 L dist ulna

B7608 L carponda

B7803 R femur

B7443 L femur

B7460 L dist femur

B7461 prox radius

B7026 R Tibia (in mt.)

B7744 L Tibia (in mt.)

B7715 R dist ulna

B8000a

B8039

B8114

B8303

B8309

B8376

B8002

B8313

B8310

VB8315

R coracoid

furcula Left clavicle

furcula in mt.

furcula in mt.

R coracoid

L humerus

R dist femur

L prox ulna

Left clavicle

Complete
excavated
9 cuts

B6865 frag. pelvis (acet. R) inserted after finding specimen in collection 1972

Other Misc. #s

H 3837 L coracoid in mt.

J 9402 R carponda (illus).

J 9629 L shaft + dist femur?

K 3353 prox ulna in mt.

B 592 dist ulna in mt.

1592?

40
50
58
148

44
14
58 This page

Sternum 7
 furcula ~~4~~ 7
 scapula 13.
 coracoid 21.
 humerus 15.
 ulna 18.

Radius 2

carp. 17

pelvis ~~6~~ 7

femur 22

tibia 18 or 20

147

— 2 radius

145

Tables of measurements
of individual specimens
of each element

Beagly's study

✓ ✓ ✓
A B C D

Do NOT
use
Too difficult
to measure
✓

Sternum - Breagys study

July 1973 Sternum

	Br. shield backed and costal process	gr. length costal row	Length burn dorsal edge to end of costal row	Br. across ventral labial prominence	Alth. caprine shield at four costal rows	Ratio AC %	Ratio EC %	Ratio BC %	Ratio DC %	Ratio BD %	Ratio DA	Ratio BA	Length manu- brin to posterior labial process						
B 5428 Paeagys	71.0	44.5	73.7 72.0	62.2	35.8	98.8	49.6 48.5	61.7	86.3	71.5	89.5	62.6	154.02	49.6	44.8	49.5	3) 143.9	47.9	
B 3372	73.3	46.9	74.2	65.2	34.1	96.2	44.8 46.7	61.5	85.4	72.0	89.2	64.0		39.6					
B 4554	73.8	43.5	72.7 73.0	66.2	36.2	101.0	49.5	59.5	90.3	65.7	89.8	59.0		40.4					
B 3071	72.1		72.1	64.4	38.1		50.3	60.9	87.4	69.7	88.8			43.6			4) 167.0	41.7	
B 3783			72.1	64.4	38.1		50.3	60.9	87.4	69.7	88.8			43.6					
Gym. calyp. 139	70.0	50.7	81.0	60.9	32.8	86.5	39.6	62.6	75.3	83.4	87.0	72.5	151						
302	66.5	49.7	77.7	60.0	30.4	85.5	40.4	64.0	77.3	82.9	90.1	74.7	145						
1052	72.5	48.3	77.0 76.6	60.7	32.5	94.2	43.6	62.9	79.2	79.5	89.0	66.8	151						
371	66.7	47.4	74.7	61.8	32.9	88.2	43.4	62.6	80.5	77.6	91.4	71.0	150						
31	70.5	48.7	76.6	60.6	33.5	88.6	41.8	62.6	80.5	77.6	91.4	71.0	150						
B 6697	70.5	52.7																	
B 6647	69.5	54.5																	
B 6011	73.5	49.4	78.2	63.4		93.9													
B 2410	70.2	52.9																	
B 1889	73.0	51.5																	
B 6647	70.5	54.6																	
B 5326	72.8	59.4																	
B 7773	70.9	57.0	84.5	63.5															
B 5340	74.8	57.2																	
Vultur 218	74.3	46.0	78.9	61.4	33.6	94.2	43.6	58.5	78.2	74.7	83.1	62.0	156						
1734	80.4	49.4	84.6	62.4	34.5	95.0	40.6	58.3	79.5	73.3	83.8	61.5	147						

Main distinction is shape of carina which has a more
angular contour than in either Gymnogyris or Vultur.
The deepest ~~part~~ part occurs ^{at about the same level as the} apex and lies with
the posterior most costal process. In Gymnogyris the
carina has a long even curve until well past the
costal ~~process~~ row it ascends ^{rather} abruptly to the shields.
The ascent is more gradual in Vultur & begins just
back of costal row.

Nov. 10, 1971 *Stamm*
 T additions May 1973
 Worksheet 3-

[illegible]

	Length to back of fin.	bc head (facit)	C belov facit	Ratuo ba	Ratuo cb	Groat length	gr ext lvs	Ratuo da	Ratuo ca	Ratuo db	meas. qr length to apt end sternal height	Vf Depth from snout base	dc Ratuo Depth to R base	de Ratuo BA M mops	er	scapula cr	acrom sh	SD	
B0743	96.9	27.8	20.7	28.4	75.30	100.2	105.9	15.0	21.4	52.5	112.3	14.5	52.59	70.0	28.2				
R218	96.8	27.7	20.7	28.3	"	100.3	107.6	15.1	-	52.7		14.6	53.20	70.5	28.6	30.2	29.3	21.5	11.1
V. gupis 1734	104.0	31.6	23.2	30.3	73.5	107.6	117.6	14.4	22.2	49.2		15.2	48.1	65.6	30.3				
B8039	95.7	22.7	20.3	23.7	89.4		105.9	13.2	21.2	56.0	-	12.9	56.0	62.6	23.7		get meas below fin		
B1739	97.6	24.1	21.2	24.6	88.3	100.0	111.7	14.1	21.4	57.3	111.6	13.8	57.3	65.0	24.6				
B3242	97.8	24.3	21.1	24.8	87.0	99.8%	110.4	13.5	21.4	54.3	110.5	13.2	54.5	65.7	24.8				
B1638	99.9	26.0	21.4	-	-		113.2	15.3	21.4	58.4	112.9	13.2	58.6	61.1	-				
F1679	24.1	21.8	-	22.4	-		113.2	-	-	54.8	-	13.2	54.7	60.6	-				
B7479	101.8	-	21.5	-	-		113.2	12.7	21.1	-	113.6	12.9	-	60.0	-				
B8376	95.4	24.4	21.3	26.6	83.8	98.0%	109.7	13.7	22.2	51.5	109.7	13.1	51.6	61.5	26.4				
B3821	102?	25.1	21.5	24.6	85.9	-	113.5		21.0	56.9	113.5	14.3	57.0	66.5	26.6?				
B3424	101.6	-	21.8	-	-		113.2?	14.0	21.0	-	111.2	14.2	-	66.0	-				
B1499	96.6	23.1	20.7	23.8	89.7		109.7	13.0	21.4	54.6	110.0	12.3	54.5	60.7	23.9				
B2644	99.8	24.3	-	24.3	89.0		113.4	13.0	21.4	56.0	-	13.0	56.4	63.3	24.3				
B02	97.3	25.7	22.2	26.4	86.5	-	109.4	12.9	22.8	49.1	110.3	12.6	49.0	57.3	26.4				
371	97.6	25.8	23.1	26.4	89.7	101.5	112.6	12.5	23.5	47.4	112.7	12.2	47.0	52.7	26.4				
31(1)	98.9	26.2	21.9	24.5	83.0	102.2	112.5	12.9	22.1	48.8	112.6	12.8	48.9	58.3	26.5				
31(2)	92.9	24.0	21.5	25.9	87.5	96.0	105.3	11.7	23.2	45.8	105.5	10.9	45.5	50.7	25.9				
269	96.5	25.0	21.5	25.9	86.0	-	109.0	11.9	22.5	46.0	108.9	11.5	46.0	52.4	25.8				
575	97.3	22.9	20.4	23.5	89.3	99.9	109.8	12.1	21.0	51.5	110.0	11.8	51.5	57.9	23.5				
1052	94.3	24.0	21.5	25.4	89.5	96.0	108.3	12.0	22.8	47.2	108.4	11.3	47.0	52.5	25.4				
mean below 247	97.0	24.3	21.1	25.0	82.0	100.2	109.7	12.7	21.7	51.2	109.7	12.4	51.1	58.7	25.0				

11.2 M.
1008 meas.
used
by H. Fisher

Aug. 1971

Scapula

[illegible]

2/4 258.5 1558 4) 1927
 2775.4 48.3 48.3 48.3
 21 5329 and not
 4647 int.

Breagys humeri

See plain yellow sheet for later figures Sept 1971

150 180 150
 119 182 104
 269 263 254

	A	not to cut Br	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
	gr length	dist gr.	on dist less	act cond furn process	Depth dist end	Br pux thru med. rubra cut	Br pux thru bicip tal crest	Length Bicipi tal crest	Length deltoid crest	Length deltoid crest	Ratio HA HB	Ratio HG	Ratio H/I	Ratio GI	Ratio IA	Ratio FG	Ratio S/D	Br shaft mid	Ratio BA	Ratio GA		
Ry W B8002	256	48.3	42.9	23.0	26.4			46.6	106.0	11.1	15.2		44.6	—	41.5		47.2	19.8	18.8	20.1		
B77397 B7737	262.0	49.2	43.2	23.0	25.6	51.9	—	45.4	—	11.0	17.4		—	—			47.8	18.8				
B58207 B48473	267	48.3	42.5	23.2	26.1	51.9	58.8	48.4	114.0	11.7	18.1	89.0	42.1	52.9	42.6	87.4	48.3	18.1	22.0			
B2156 B4954						54.2	60.3	48.4	116.2		—	80.5	41.5	52.1	40.0			21.3				
B72474 B2034	275	50.1																21.8				
B2034 B1583						53.5	57.3	43.7				80.7	—	—		93.3		20.1				
B6318L B2083						56.5	64.0	48.5	124.5			81.3	43.6	53.5		88.3						
B7730	260.0	46.7	41.3	24.9	25.5	52.3	59.2	47.9	116.0	11.7	18.8			43.3			21.6	17.9	17.3			
Bulfinch 1734	280	52.3	45.7	26.7	27.2	55.9	62.1	51.7	122.2		18.4	83.2	42.2	50.7	43.6	90.0		18.7				
218	272.2	49.5	43.1	26.7	26.6	52.6	57.9	49.1	114.5		18.0	85.0	42.9	50.5	42.0	91.0		18.1				
Gunnepet 260	273	47.8	—	24.0	27.3	52.3	54.7	48.3	117.5	9.1	17.4	88.2	41.7	46.5	42.4	95.6	37.8	17.4				
141	269	46.2	40.5	23.4	25.5	49.4	55.1	44.9	115.0	10.1	16.6	81.3	39.0	47.8	42.7	89.3	43.2	17.1				
1050	270	47.4	41.3	23.1	26.6	49.0	55.7	45.9	114.2	9.9	17.0	82.3	40.2	48.7	42.3	88.0	42.6	17.5				
371	271.7	47.1				53.9	58.3	48.8	118.7		—	83.5			170.0	92.3		17.3				
1052						52.3	56.5	47.2	—			83.3				92.5						
from Fisher						53.5	57.3	43.7	116.2													
length calcd	208-213																					
capitulum	212-244																					
Smith Creek	296.3	Br. dist	52.5																			

not measured 52156 use mix
 B7247 1 dist, B2034 use dist.

		A length Synsac	B Meas. Pelvis interacetabular width	C br. pubis to CA	D ant. high ant. to	E Coast ant. to	EX 25.4%	length ant to acetabulum	Glenn-H ant. ilia	15 post ant BA			
Buayke	B1082	142.6	55.5	79.1	55.9	82.4	52.6	40.5	92.2	68.6	1432	39.1	
"	B3346	141.5	—	—	—	—	—	—	100.6	—	—	134.0, est	
"	B7898	146.4?	—	—	—	—	—	—	—	—	—	—	
"	B1635	140.5	—	—	—	—	—	—	90.5	—	—	—	
"	B6859	152.1	—	—	—	—	—	—	328.3	—	—	—	
Vulture	218	130.2 <i>longer transition</i>	55.8	77.9	52.6	85.8	65.6%	45.9	33.2	89.8	69.1	132.6	42.8
"	1734	163.0 <i>longer transition</i>	61.2	84.1	51.4	92.8	52.0	47.8	29.3	108.2	66.5	146.3	37.2
Gym.	141	134.5 <i>longer with ilia</i>	54.7	82.3	61.19	79.9	52.8	42.8	31.8	93.7	69.6	129.3	40.6
"	371	152.3 <i>longer transition</i> (158.3?)	52.0	83.9	56.4	83.0	54.2%	44.3	29.1	102.6	67.2	135.5	37.4
										2) 19.63			
										98.1			

Pelvis &
Humerus
1973
(ulna on
reverse
side)

	Humus									
	length	length	width	width	length	ratio	ratio	ratio	ratio	ratio
	deltoideus	deltoideus	deltoideus	deltoideus	deltoideus	deltoideus	deltoideus	deltoideus	deltoideus	deltoideus
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length	length	length	length	length	length	length	length	length
	length	length								

1973
figure

	Prox Distance from base to bicip attach	Ulna Pro base to	Ulna Pro at bicip	Radius dist to bicip (radius)	h base
B1910	18.6	30.1	16.6	B6782 21.9	13.7
B3838	17.0	31.5?	19.1		
B4630	18.4	30.0	16.8		
B7248	20.0	31.4	18.7		
B4221	19.3	30.3	12.1		
B8310	17.4	30.9	17.6		
B6912	20.5	—	18.7		
q 1050	15.9	30.7	18.7	18.5	13.9
longest 269	17.0	30.7	18.0	19.5	13.3
141	18.2	30.4	12.7	17.7	13.5
longer V 1734	19.7	31.8	19.7	23.5	15.5
longer 269	19.4	30.4	16.9	12.0	12.6
longer 269	17.8				

Brachy-
prox ulna
very pneumatic
in brach inf.
some accordingly.
more so than
g. slightly more
than ✓

Prox of M1

is longer prox. distal
more ulnar

14.6 (V. 12.8 & 12.3
13.2 S. 12.9 & 13.3
15.1
14.2
4.571 (M=14.2)

	Stegial Length to end costal row to length of symphysis	Ratio 5
Brachyptera	72.8 - 78.9 (M 75.9)	51.7% - 53.7 (M 53.3)
	140.5 - 146.4 (M 142.7)	
Gymn.	75.7 - 81.0 (M 78.2)	56.4% - 53.2 (M 54.9)
	134.5 - 152.3 (M 142.6)	
Vultur	74.9 - 83.3	57.6% - 51.2%
	163 - 130 130 163	

Ratio depth to width chune	
30.7 - 29.2	42.3% - 40.5%
22.7 - 13.7	
28.3 - 29.4	40.8% - 38.6%
69.4 - 76.4	
33.3	40.0%
83.3	

Ratio heel to atchula length of humerus		To costal back length
34.8	35.5% = 47.2%, 45.1%	103.6, 96.3, 103.3
74.0	28.9	58.5, 58.5, 58.5
31.3	32.3	91.4%, 40.9%, 40.7%
75.7	81	85.6
31.9	28.1	
83.3	34.4	93.5%
83.3	74.9	102.9%

Ulu
+ radius

	Length dist	Length to coracoid	M Br. max coracoid	br dist and true humerus	Depth dist and ext	distance from ext. coracoid to bicipit.	M 26.3 depth prop end ext						Length	br dist	br max coracoid	dist to acromioclavicular joint	br dist			
Bumby B7715 + dist B4630 pr	340.0	321.5	30.0			18.4							Bumby dist B7661	310?	28.1					
B7715 + B6912 pr	365.5	341.5				20.5							pr B6282		13.7	21.9	12.7			
B8310 pr						17.4	26.8													
B1910 pr			30.6			18.6	26.3													
B6923 pr			30.3																	
B4221 pr			30.3			19.3	26.0													
B3838 pr			31.7			17.0														
B6914 dist				25.5	21.6															
B7248 pr						20.0														
Q. calif 141	311.8	297	33.0	22.6	23.6		25.5						141	297	21.7	13.5	17.7	12.5		
269	320.	303.3	30.6	22.2	22.7		24.9						269	305	21.4	13.3	19.5	12.3		
1050	316	300.5	31.0	22.7	22.6		24.4						1050	299	22.1	13.9	18.4	12.1		
37	947 315						2748 249													
V. Gypsus 218	330	313	30.5	22.3	22.8		26.7							315.6	22.8	12.6	17.0	12.0		
1734	334.3	337	32.6	25.0	25.2		28.5							338.3	24.3	15.5	23.4	12.5		

Hummer

Measurement	Value	to be kept	20
B7730	257.2	55.2	20.3%
B8002	255.0		
B7737+	261.0	58.5	22.5%
B5329	265.0		
B72476+	251.0	30.1	max. acc. in
B72476	251.0		
B4954	1319.0		
B72476	2638		

Measurement	Value	to be kept	ratio
B8175	278.5	60.0	21.5
B2831	272.0	59.5	21.8
B6532	281.5	61.5	21.9
B7427	271.0		
B6531	280.8	62.9	22.4
B6421	281.5		
B4889	270.2	60.5	22.3
D5045	296.5		
B7472	286.7	61.8	21.5
B7120	260.5		amplius

Measurement	Value	to be kept	ratio
B3336	312		
B8244	318	303.0	30.5 22.5 22.5
B8014	336.5	324.0	33.2 25.1 25.7
B4480	343.1	329.5	33.0 23.8 25.9 27.2
B13098	39536	1967	3714 3741
B327.4	317.8	32.2	25.4 24.7

Measurement	Value	to be kept
141	297	21.7
1650	299	22.1
349	305	21.6

Measurement	Value	to be kept
B6782	13.7	
B1050	18.5	13.9
B269	19.5	13.3
B141	17.7	13.5
B1331	23.8	15.5
B218	17.0	12.6

Ulnae, Radius, Volaris

Measurement	Value	to be kept	ratio
B30	354.3	30.5-32.6	26.7-28.5 22.3-25.0
B15.6	338.3		22.8-25.2

Measurement	Value	to be kept	ratio
B5036	336	327	325 304.5
B2574	310	308.8	286.0
B1436	31.0	26.1	31.3
B8176	25.7	24.6	24.0
B3045	25.6	23.1	

Measurement	Value	to be kept	ratio
285	326	228	
247	305	450	
152	631	24	
27.4	315		

(Extremities)
radius
ulna
volaris
humerus

9. *g. callis* *Stenura*
 or, *Stenura* *Stenura*
 B 5005 73.0
 B 6047 69.5 54.5
 B 6011 73.4 49.1
 B 1889 112.8 52.0
 B 5042 52.3
 B 5340 74.8 57.2
 B 7773 70.9 57.0
 B 6012 72.1 59.2
 B 4891 73.7 50.4
 B 2610 *measured* 70.0? 52.0
 S 5326 72.3 59.4
 B 1889 72.8 51.5
 11) 7949 ⁷² 11) 5926 (58.5)
₂
₁₂
₁₂

Stenura *Stenura*
 B 3372 72.7 46.8
 B 4541 4.5 43.2

Stenura *Stenura*
 B 3342 141.2 141.2
 129.2 136.2
 + 13.8 2 4.6
 B 1438 143.0 140.8
 3) 431.0
 B 7895 146.8 of 143.9
 B 6859 *can't be used* 141.2
 1092+1082 142.8 142.8
 3) 430.8 or 431.4 142.8
 143.6 3) 430.8
 143.6

Stenura *Stenura*
 B 8310 31.2 26.8
 B 1910 30.6 26.3
 B 4630 30.6
 B 6925 30.3
 B 4221 30.3 25.9 (26.0?)
 B 3838 31.7 3) 79.0 (26.3)
 B 1841 (30.7) 25.9 (26.0?)
 B 4630 *with* 273.0 *add 55.2 = 327.2*
 B 7715 273.4 *add 5.4 for 4630 = 327.7*
 B 7715 273.4 *add 69.7 to dist of 4630 = 327.7*
 273.4 34.2 *add 7.4 " " "*
 34.0 *for 4630*

Stenura
 B 6914 21.5 21.6
 Length of ulna est 327 - 340 - 342

Stenura *Stenura*
 141 - 297. 330 24.5 22.6 23.6 *to 311.8*
 269 303.3 306 24.9 22.2 22.7 *to 320*
 1050 300.5 31 24.4 22.7 22.6 *to 316*
 3) 900.8 99.6 74.8 67.5 168.9 3) 947.8
 300.2 31.5 24.9 22.5 22.9 315.9

23.6% head
 B 1811
 Length 31.0

See sheet attached (with
for details

Ulna

of calf

of amphius

Breagyns

Length to
base

303.3 - 297.0 (M 300.2)
3 bones

329.5 - 303.1 (M 317.8)
3 bones

extd
327 - 342 (M 33.4)

Length to

olecranon

320 - 311.8 (M 315.9)
3 bones

343 - 312 (M 327.4)
4 bones

extd
340, ext. for 1

Br. prox

33.0 - 30.4 (M 31.5)

33.2 - 30.5 (M 32.23bm)

31.7 - 30.0 (M 30.7)
6 bones

Depth prox

25.5 - 24.4 (M 24.9)

27.2 (one bone only)

26.5 - 25.9 (M 26.3)
3 bones

For dist

22.7 - 22.2 (M 22.5)

25.1 - 22.5 (M 25.4, 3 bones)

25.5 (1 bone)

depth "

23.6 - 22.6 (M 22.6)

25.9 - 22.5 (M 24.7, 3 bones)

21.6 (1 bone)

dist to tip

15.9 - 18.2 (M 17.6)

Radius

Length

297 - 305

315.6 - 335.3

289.5 - 312.3

ext 310

Br dist.

21.6 - 22.1

22.5 - 24.3

21.4 - 23.6

25.1

ratio

7.1 7.4 (M 7.2)

7.2 7.2

7.1 7.1 - 7.6

8.120

7.3

7.4

7.1

3) 218
72

7.6 M 7.3

24

7.1

3) 221
73

Humerus

Ulna

Length

275 - 269 (M 271.7) 280 - 272

296.5 (M 275.9) 260.5

281 255 (M 263.8)
265 255 (M 259.5)

Ratio
hum to
ulna

90.7 - 90.5

83 - 87.

90.0 - 87.3 - 87.4

74.5 77

Ratio
hum to
carpus

300 - 194 (M 194)

195 - 199

193 - 189 (M 184)
183 - 183 (M 183)

ulua
V gyphus

337.0 - 313 26ms

354.3 - 330 26ms

32.6 - 30.5

28.5 - 26.7

25.0 - 22.3

25.2 - 22.8

Ulna

340

342

327

3100.9

33.6

Length to art. $\frac{B}{\text{mm}}$ $\frac{B}{\text{mm}}$ $\frac{B}{\text{mm}}$
 $327 (4630 + B7715) 342 (B7715 + B6912) 340 (B7715 + B7248)$

~~Length to~~

~~art.~~

Pr. prox

depth "

g. br. dist

dist. dist

max 31.7, min 30.0, mean 30.7 (6 bones)

26.8 25.9 26.3 (3 bones)

25.5 (1 bone) only one measurable $\pm B6914$

21.6 (1 bone)

Radius

length radius
 — ? 310??

Left Rn. dist. dist $\pm B7661 = 25.1$ — Breviphs

" " " B1411 = 23.6 — Q. amplus

Radius $\frac{B}{\text{mm}}$ $\frac{B}{\text{mm}}$ $\frac{B}{\text{mm}}$
 $297 B141 = 21.7$ — Q. calif

300.5 B1050 = 22.1 — " "

320 303.3 B1369 = 21.6 — " "

330 313 B218 = 22.8 — V. gryllus

354.3 337 B1734 = 24.3 — V. gryllus

B8017 = 22.4 Q. amplus

B1445 = 23.3 " "

B6047 = 21.4 " "

310mm

297

299

305

315.6

338.3

312.3

incomplete

289.5

Humeri

Breviphs

Q. amplus

Q. calif.

Length 255 - 281 (M264) 260.5 - 296.5 (M275.9)

269 - 275 (M271.7) (4)

only one only (265)

Tarsometatarsi

Breviphs

Q. amplus

Q. calif

V. gryllus

Length tarsometatarsi 110.4 - 125.7 (M. 117.9)

109.9 - 131.7

113.3

125.1

ulna

141
18409

Baeophis et al

Carphometacarpus

Feb 2, 1972

Carphometacarpus

M241.0 M228.6 M243.5 M234.2 M231.9 M221.1 M201.1 M214.3 M210.1 M211.0 M242.2 M22.7

	Ext length to smooth base M2	Length prox symph. to int process	Length distal symph. to M3 base	Depth prox and int	Depth prox ext.	HT MI extly to ext base	Ratio ba	Ratio ga	Ratio ca	Ratio da	Ratio ea	Ratio ba	Ratio ga
R J 9402	145.8	28.2	17.7	34.6	32.3	21.0	19.3	14.5	9.9	23.7	22.9	14.4	42.0
R B 3625	143.7	27.0	16.5	33.9	31.6	22.1	18.8	14.9	10.3	23.6	22.0	15.3	44.0
R ² mt B 2667	142.8												
R B 5331	141.8	27.8	16.4	34.7	31.8	22.4	19.6	13.9	11.2	24.4	22.4	15.9	45.8
mt B 2181	143.1												
L B 3154	138.8	28.7	15.7	34.1	32.0	21.9	20.3	14.2	10.2	24.6	23.0	15.8	41.6
L B 4375	141.3	28.8	16.8	34.5	32.5	21.6	20.4	14.5	10.2	24.4	23.0	15.3	42.0
L B 1075	140.4	28.8	14.9	32.7	31.1	21.2	20.5	14.4	10.2	23.2	22.1	15.1	44.1
L B 7608	139.2	28.7	17.2	34.0	31.8	20.5	20.6	13.4	9.6	24.4	22.8	14.6	—
L B 2632	141.8	26.9	14.2	34.0	31.9	20.0	19.1	13.9	9.8	24.0	22.5	14.1	41.9
R B 3271	138.4	28.3	14.4	34.9	32.0	19.7	20.3	14.2	10.5	23.9	23.8	14.7	40.6
R B 2168	140.4	30.8	—	34.3	32.7	21.1	21.9	13.8	9.6	24.4	23.3	15.0	39.4
R B 1755	138.4	28.9	—	34.0	31.8	21.0	20.9	14.7	10.6	24.6	23.0	15.2	43.3
R B 6712	—	30.8	—	34.2	32.4	21.7	—	15.0	—	—	—	—	43.9
L B 6395	143.6	28.4	13.3	34.6	32.2	21.7	19.8	13.8	9.6	24.1	22.4	15.1	40.0
L B 4160	—	28.3	14.1	34.7	31.6	20.2	—	14.1	—	22.9	22.3	—	40.6
Veter 218	136.7	26.3	20.7	35.1	32.5	20.1	19.3	12.4	9.1	25.7	23.8	14.7	35.3
1734	143.5	28.0	21.3	38.9	35.0	21.0	19.5	12.7	8.8	27.1	24.3	14.6	32.7
Gymnophis 141	135.8	31.1	15.7	34.9	32.7	20.4	22.8	13.4	9.8	25.8	24.1	15.1	38.4
269	136.1	31.3	15.6	35.0	32.5	19.0	23.0	13.0	9.5	25.7	23.6	13.9	37.2

See yellow sheet

(Aug 1977)

Caipomelacarpus *Brady*

	A Depth ext. to trant tip M1	B Int Depth thru pore M1	C ext Depth thru pore M1	D Int M1 ext	E Distance pore symm. to int edge thickness	F Length under micro scope	X Factor at tip of M1 process to length	Y Length	G Least diagonal br. of neck below thickness M1	H Least ht (cont) distal metals sample	I Ratio EA	NO Good Ratio CB	NO Good Ratio DA	✓ Ratio BA	✓ Ratio FA	✓ Ratio EF	✓ Ratio DB	Ratio DC	CA
J9402	145.9	34.5	32.3	22.1	40.0	88.5	7.0	12.7	8.7	13.0	27.4	93.5	15.7	23.6	60.5	45.2	64.9	65.4	
B3625	143.6	33.5	32.0	22.5	39.6	87.7	5.8	13.2	16.6	13.2	27.5	95.5	15.6	23.3	61.1	45.1	67.3	70.4	
B6895	143.8	34.7	32.2	22.1	41.4	89.4	7.0	14.5	8.0	10.4	28.7	93.0	15.3	24.2	62.8	46.4	63.7	68.7	
B4375	141.4	34.3	32.4	22.5	40.9	85.0	6.0	14.2	18.4	12.3	28.8	94.5	15.9	24.2	60.1	48.2	65.6		
B5331	141.7	34.9	32.0	22.4	40.1	85.3	6.3	13.1	19.4	12.5	28.3	91.9	15.8	24.6	60.1	47.1	64.3		
B7608	139.0	33.9	32.3	20.6	40.3	82.3	6.8	12.5	17.3	12.6	28.8	95.5	14.8	24.3	59.1	48.9	59.1	62.0	23.2
B1075	140.5	32.8	31.4	21.2	40.6	85.0	5.7	13.5	16.8	10.9	25.8	95.9	15.1	23.3	60.5	47.8	64.6	67.7	
B3154	138.7	34.0	32.3	22.1	40.2	82.8	6.8	12.0	18.0	12.5	29.0	95.0	15.9	24.6	60.5	48.6	65.0		
B6712	145.3	34.5	32.6	21.7	43.7	87.0	6.8	13.0	18.5	—	30.0	94.6	14.9	23.6	59.6	50.4	63.0	66.5	
B4160	155.1	34.3	31.8	20.8	40.3	78.5	6.6	12.7	18.3	10.7	30.6	92.8	15.6	24.6	59.0	52.5	60.6	65.6	22.9
B3271	134.5	34.5	31.8	22.1	40.5	85.4	6.2	12.0	19.5	12.6									
B31755	132.9	31.6	33.9	21.4	40.6	—	6.0	13.0	17.9	—									
Gymnophis B1141	136.0	35.0	32.7	19.7	43.9	76.2	6.2	10.9	19.0	11.7	32.3	93.3	14.5	25.6	56.0	57.5	56.5	60.4	24.9
Vagabond 218	136.1	35.4	32.5	20.0	38.6	77.7	6.5	12.5	18.4	13.7	28.3		14.7	26.0	57.1	49.6	56.4	61.6	23.8
" 1734	143.5	38.8	35.4	21.0	41.7	79.8	7.0	13.0	20.4	16.3	29.0		14.6	27.0	55.6	52.3	54.2	59.4	24.6
Gymnophis 269	136.4	34.8	32.2	19.8	43.6	78.7	7.0	11.1	17.4	11.6	32.0		14.5	25.5	57.5	53.4	56.8	61.5	
Coraxipha 228	75.6	19.8		11.7	24.6	41.5							15.4	26.2	53.0	59.4			
Coraxipha 716	76.0	19.7		10.7	24.0	43.8							14.0	25.9	57.6	54.8			
Coraxipha 1360	66.6	18.0		9.9	23.7	35.4							14.8	27.0	53.2	67.0			
Sarcophaga 737	86.3	22.7		12.5	28.2	48.6							14.4	26.3	56.3	58.0			
Cathartes 18	82.0	22.2		12.7	29.7	41.2							15.4	27.1	50.2	72.2			

ferre

	Ant. Length to head	Ant. length to filling place (pure)	Max Prot for ant and pattern bases	Max dist for	for across ext + condyle	Depth head (ant-post 1/2)	Least dimension of shaft (middle)	Gr shaft dimension just distal to trochanteric crest	Depth femoral condyle	Depth ext + condyle	Depth with condyle caliper flat partly	Ratio H/C	Ratio BA	Ratio CA	Ratio FA	Ratio GA	Ratio EF	Ratio D/A	gr length
B5873	136.8	136.8	40.2	38.2	31.5	17.3	16.1	15.9 21.2	25.6	30.1	22.3	67.9	29.39	27.9	117.9	11.6 15.5	107.9	23.9	—
B3358	139.5	139.4	40.3	39.2	31.7	17.4	16.3	16.1 20.9	27.7	31.4	21.2	70.6	28.89	27.8	117.9	11.5 15.0	106.9	22.7	147.5
B4693	130.9	130.7	36.8	35.3	28.0	16.2	14.5	14.0 19.3	23.2	28.7	20.4		28.2	27.0	11.1	10.7 14.8	110.9	21.4	138.6
B6259	129.7	129.0	38.3	35.5	28.5	16.8	15.0	14.7 18.7	24.2	27.8	19.7	68.2	29.7	27.5	11.6	11.4 14.5	112.0	22.5	138.5?
B4989	137.9	137.8	40.5	38.4	30.9	17.2	15.4	15.1 20.3	27.1	30.4	21.1	70.6	29.4	27.9	11.2	10.4 14.6	111.8	22.4	147.2
B1404	137.1	137.1	40.2	37.9	31.1	17.4	16.2	15.7 21.9	25.4	30.7	22.2	67.2	29.3	27.6	11.8	11.4 14.8	107.3	22.6	145.0
B7803	130.5	130.5	39.5	36.9	30.6	16.2	15.3	15.1 21.0	25.1	29.4	20.0	67.0	29.1	28.2	11.7	11.3 14.1	106	23.4	—
B5580	137.5	137.4	38.8	37.4	30.5	17.4	15.8	15.4 20.0	26.5	30.1	20.7		28.0	27.2	11.5		110	—	—
B7493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4		29.8	27.7	11.7		10.4		149.2
B3493	140.9	140.8	42.0	39.0	33.4	17.3	16.5	16.3 22.2	25.5	29.0	21.4								

DC Ext cond. deeper than int as in g.

crayfish like or
#228 146.95 / 149.0
length

Measurements of Tibiotarsus
(in millimeters)

also get
greater length
from

Get greater length
from
to length of

	Breagyps clarki			Gymnogyps californianus ^a			Vultur gryphus (2 bones)	
	max.	mean ^a	min..	max.	mean	min.	max.	min.
Length to proximal art articulation	234 227ap	223 (4)	214	213	210	208	251 240.5	243 235 235.5
Breadth distal end	25.7	24.4 (11)	23.7	25.5	24.3	23.3	26.2	25.8 25.4

Measurements as given by Fisher (1947:234). Single specimen at hand measured.
~~a figure in () = no specimens measured (probably to extent?)~~

Measurements of Ulna

(in millimeters)

Length olecranon ext	343 340 329	338 336 329	314 312 300	320 320 320	316.0 315.9	312 311.8	354 353 337	342 340 313
Length to articulation	333 332 327	321 320 336	314 312 342	308 307 308	300.8	296	337 336 337	323 322 313
Br. prox articulat.	330 329 31.7	321 320 30.7	30.0	33.0	31.5	30.5	32.6	31.5 30.5
Depth ext from olecranon	26.8	26.3	24.9	25.5	24.9	24.4	28.5	27.6 26.7
Br. distal end	22.7 22.7	25.5 22.7 (1)	22.2	22.7	22.5	22.2	25.0	23.7 22.3
Depth dist (ext.)	23.4 23.4	21.6 22.7 22.7	22.6	23.4	22.9	22.6	25.2	24.0 22.8

Radius

	Prox. length	Dist. length	Prox. length	Dist. length	Prox. length	Dist. length
B9878	223.0	216.0	99.3			
B6414	214	208.0	99.3			
B4031	221.5	217.2	99.0			
B9629	234.0	226.5				
V. 1734	251.0	244.5				
V 218	236.6	229.8				
	248.66					
	243.3					
Gym. 1050	316.0	301	299			
" 269	320	301	304			
" 141	312	296.4	296.0			
V. 1734	354.2	336.5	334.5			
218	330.2	313	314.0			
B7718 det	330.0	318	298.7			
B7715 det	330.0	310				
B6644 det	343	333				
B7715	331	314				
B8510	331	314				

Measurements of sternum
(in millimeters)

Apr. 27, 1943 12
To be checked

	<u>Breagyps clarki</u> max. Mean ^a Min. 3 specimens			<u>Gymnogyps californianus</u> max. mean ^a min. 4 specimens			<u>Vultur gryphus</u> (2 specimens) max. mean ^a min.		
Length costal row	46.9	44.9 ⁽³⁾	43.5	50.7	49.0 ⁽⁴⁾	47.4	49.4	47.7	46.0
Breadth of shield at first intercostal space	73.8	72.8 ⁽³⁾	71.0	72.3	69.0 ⁽⁴⁾	66.5	80.4	77.3	74.3
Ratio (%) length costal row to breadth of shield	64.0	61.8 ⁽³⁾	59.0	74.9	71.2 ⁽⁴⁾	66.6	62.0	61.7	61.4
Length from dorsal lip of coracoid sulcus	38.1	36.2	34.8	32.4	31.9 ⁽³⁾	31.3	34.5	34.4	34.4
Length of costal row	78.9	75.9 ⁽³⁾	72.8	81.0	78.2 ⁽³⁾	75.7	83.3	81.9	77.9
Ratio br. shield to this length	101.6%	96.8%	93.0	88.2	86.5	85.0	96.4	99.4	99.4
Measurements of Scapula (in millimeters)									

Measurements of Scapula
(in millimeters)

	<u>Breagyps clarki</u>			<u>Gymnogyps californianus</u>			<u>Vultur gryphus</u> (2 specimens)		
	max.	mean	min.	max.	mean	min.	max.	min.	
Breadth through acromion and glenoid facet	32.2	30.3	28.7	30.5	28.8	27.6	29.8	26.8	
Ratio length acromion to breadth scapula (in per cent)	75.4	71.8	68.5	75.0	72.9	68.5	89.5	81.2	
Length of acromion	23.3	22.1	21.5	22.0	21.0	20.2	24.3	24.0	

Measurements of Coracoid
(in millimeters)

	<u>Breagyps clarki</u>			<u>Gymnogyps californianus</u>			<u>Vultur gryphus</u> (2 specimens)		
	max.	mean	min.	max.	mean	min.	max.	min.	
Length to sternal end mediad of angle	102.0	98.7 ⁽¹⁰⁾	95.4	98.9	96.4 ⁽⁸⁾	92.9	104.0	96.9 ^{100.4}	
Breadth across triosseal canal	21.8	21.3 ⁽¹²⁾	20.3	23.1	21.6 ⁽⁸⁾	20.4	23.2	20.7 ^{21.9}	
Breadth furcular facet	26.0	24.3 ⁽⁹⁾	22.7	26.2	24.7 ⁽⁸⁾	22.9	31.6	27.5 ^{29.5}	
Height furcular facet	15.2	13.5 ⁽¹¹⁾	12.6	12.8	11.9 ⁽⁸⁾	11.3	15.2	14.5 ^{14.8}	
Ratio (%) height furcular facet to breadth across triosseal canal	71.0	63.9 ⁽¹¹⁾	60.0	58.7	55.0 ⁽⁸⁾	50.7	70.8	65.6 ^{67.8}	
Ratio br. triosseal canal to height furcular facet	21.4	21.6	21.3	23.4	22.3	22.0	22.2	26.4	
Ratio br. furcular facet to height furcular facet	90.7	82.8	83.7	84.5	87.2	83.8	73.3	75.3	
Ratio br. furcular facet to breadth across triosseal canal	26.6	24.8	23.7	26.5	25.2	23.2	30.3	28.2	

Measurements of Sternum

Breagyps clarki

Gymnogyps
californianus

Vultur gryphus

Length of
costal row

43.5 - 46.9 mm

47.4 - 50.7 mm.

46.0 - 49.4

MEASUREMENTS

	<u>B. clarki</u>	<u>G. californianus</u>	<u>V. gryphus</u>
STERNUM			
Length costal row	43.5-46.9 M 44.9 (3)	47.4-50.7 (4) 49.0 M	46.0-49.4 47.7 (2)
Breadth shield at 1st intercostal space	M 72.3 71.0-73.8/	66.5-72.3 69.0 M	74.3-80.4
Ratio (%) length costal row to breadth shield	M 61.8 59.0-64.0	66.6-74.9/ 71.2 M	61.4-62.0
SCAPULA			
Breadth from acromion to glenoid facet	28.7-32.2 mean 30.3	mean 28.8 27.6-30.5	26.8-29.8 (only 2 specimens)
Length acromion	20.4 - 33.3 M 21.8	20.2 - 22.0 M 21.0	24.0 - 24.3
CORACOID			
Length from head to sternal end mediad of sterno-coracoid-al angle	68.5 - 75.4 M 71.0 mean 98.7 95.7-102	92.9 - 98.9 mean 96.4	96.9 - 104.0 (2 specimens)
Breadth across triosseal triosseal canal	mean 21.8 20.3-21.8	20.4 - 23.1 mean 21.6	20.7 - 23.2
Height furcular facet	M 13.6 12.6-15.2	11.3 - 12.8 M 11.9 M 12.0	14.5 - 15.2
Breadth furcular facet	22.7 - 26.0 M 24.3	22.9 - 26.2 M 24.7	27.5 - 31.6
Ratio height furcular facet to breadth across triosseal canal (%)	60.0-71.0 mean 63.9	50.7-58.7 mean 53.0	65.6-70.5
HUMERUS			
Greatest length	256-260 mean 258.5 (4)	269.-275 mean 271.7 (4)	272-280 (only 2 specimens)
Length deltopectoral crest	106.2 - 116.5 M 111.9 (5)	114.9 - 118.5 116.4 (4)	113.3 - 121.3
Proximal breadth through bicipital crest	58.6 - 60.1 57.3-60.3 mean 59.0 (5)	54.6-58.3 mean 55.3 (4)	58.0 61.7 57.9-62.1 (Only 2 specimens)
Length bicipital crest	45.8 - 48.0 M 46.8 (5)	44.8 - 48.8 (4)	49.8-51.7
Greatest breadth distal end	46.7-48.9 mean 47.9	46.2-47.8 M 47.1	49.5-52.3
PELVIS			
Length sympsacrum	141.4-144.6 141.7 M	134.3-152.2 142.9 M	139.6-163.2
Least breadth across anterior ilia	40.6-41.6	39.9-45.2	45.8-47.6
FEMUR			
Length (internal condyle to iliac facet)	129.0-139.4 mean 134.8	126.0-134.6 mean 130.9	138.2-148.4 (only 2 specimens)
Maximum breadth proximal end	36.8-40.5 mean 39.3	33.5-36.4 mean 35.1	39.6-42.6 (only 2 specimens)
Least dimension of shaft	14.5-16.3 mean 15.5	15.0-16.8 mean 15.7	15.7-16.7 (only 2 specimens)

Measurements of Tibiotarsus
amplus

	B. clarki	G. calif ³	V. gryphus
Length to articulation	208.6-227(M212)	21 7 .5-236.5 (M224.6)	228.5-240.5
Breadth distal condyles	23.7-25.7 (M24.4)	23.9-26.8 (25.3)	25.4-26.2

Foster's measurements of G. calif	G. amplus
Length 208-213 M210	212-244 (M229)
Breadth distal 22x 23.3-25.5 (24.3)	22.3-26.2 M 241.)

	Measurements of ulna G. calif. (2 bone)	V. gryphus
Est length to ant. facet	327 (M 336) 342 318 (B21) 337 297-300.2	313 337
Est leg/L index.	340 311.8-(M(3) 315.9) 320	330-354.3
Prox breadth	30.5-31.7 (3) 32.2 30.6 (M 31.5) 33.0	30.5-32.6 31.7
Depth Distance from prox facet to bicip attach	17.0-20.5 (M(1) 18.9)	15.9-18.2 (M 17.0 (3)) 19.4-19.7 (2)

Radius

Distance from prox facet to bicip attach	21.9 (1)	17.7-19.5	17.0-23.5
--	----------	-----------	-----------

Measurements of Carpometacarpus
(in millimeters)

	B. clarki 14 bones	G. californianus 2 bones	V. gryphus 2 bones
Length from ext. trochlea to anterior face of dist. end of M2	^{M 141.0} ⁴⁴ 138.0 - 145.8	135.8-136.1	136.7-143.5
Length prox. symphysis to int. process	^{M 28.6} 26.9-30.8	31.1-31.3	26.3-28.0
Height of process of metacarpal 1	^{M 14.3} 13.5-15.9	13.0-13.4	12.4-12.7
Ratio prox. symphysis to length	^{M 20.1} 18.8-21.9 %	22.8-23.0%	19.3-19.5%
Length dist. symphysis to facet on M 3	^{M 15.5} 13.3-17.7	15.6-15.7	20.7-21.3
Ratio dist. symphysis to length	^{M 11.0} 9.2-12.3%	11.4-11.6%	14.8-15.1%
Depth proximal end (internally) through process M1	^{M (14) 34.2} 32.7 - 34.9	^{calcare} 35.1 - 38.9	^{2 bones} 34.9 - 35.0
Ratio dist process M1 to int depth prox end	^{M 42.2 (13)} 39.4 - 45.8 %	32.7 - 35.3 %	37.2 - 38.4 %
Ratio prox depth to length	^{M 24.2} 23.2 - 25.9	⁽²⁾ 25.7 - 27.1	⁽²⁾ 25.7 - 25.8

COTTON FIBER CONTENT

Measurements of Humerus
(in millimeters)

4 bones

	<u>Breagyps clarki</u> 4 bones			<u>Gymnogyps californianus</u>			<u>Vultur gryphus</u> (2 specimens)	
	max.	mean	min.	max.	mean	min.	max.	min.
Greatest length	260	258.5	256	275	271.7	269	280.0	272.2
Proximal breadth through bicipital crest	267	261	256	21.2	20.2		62.1	57.9
Length bicipital crest	48.4	46.8	43.7	48.8	47.1	44.9	51.7	49.1
Greatest breadth distal end	49.2	48.1	46.7	47.8	47.1	46.2	52.3	49.5
Ratio br dist to length	18.8	18.4	17.9	17.8	17.3	17.1	18.7	17.9

Ratio br dist to length
a (1) = no of specimen
b = not same bones as kept for meas.

Measurements of Pelvis
(in millimeters)

	<u>Breagyps clarki</u>			<u>Gymnogyps californianus</u>			<u>Vultur gryphus</u> (2 specimens)	
	max.	mean	min.	max.	mean	min.	max.	min.
Length synsacrum	146.6	141.2	136.7	152.2	142.6	134.3	163.2	139.6
Least breadth across anterior ilia	41.6	41.1	40.6	45.2	43.1	39.9	47.6	45.8

Measurements of Femur
(in millimeters)

	<u>Breagyps clarki</u> 8 bones			<u>Gymnogyps californianus</u> 7 bones			<u>Vultur gryphus</u> (2 specimens)	
	max.	mean	min.	max.	mean	min.	max.	min.
Length from internal condyle to iliac facet	139.4	134.8	129.0	134.6	130.9	126.0	148.4	138.2
Maximum breadth proximal end	40.5	39.3	36.8	36.4	35.1	33.5	42.6	39.6
Least dimension of shaft	16.3	15.5	14.5	16.8	15.7	15.0	16.7	15.7

Ratio femur to ilia

64 based on iliac measurement

60.6 60.4

Measurements of Sternum
(in millimeters)

	Breagyps clarki 3 bones			Gymnogyps californianus 4 bones			Vultur gryphus 2 bones	
	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.
Length costal row	46.9	43.5	44.9	50.7	47.4	49.0	49.4	46.0
Breadth of shield at first inter- costal space	73.8	71.0	72.7	72.3	66.5	69.0	80.4	74.3
Ratio (in %) length costal row to breadth of shield	64.0	59.0	61.8	74.9	66.6	71.2	62.0	61.4

Measurements of Pelvis

Length synsacrum	140.5-146.4 (M 142.7) ⁽⁴⁾	134.3-152.3 ^(M 142.6)	139.6-163.2 ⁽²⁾
Interacetabular width	55.8 ⁽¹⁾	54.7-52.0	55.8-61.2
Br. across post. iliac crest	79.1 ⁽¹⁾	82.3-88.9	77.9-85.9
Length ant. to acetabulum	90.5-100.6	93.7-102.6	89.8-108.2
Length from ant. edge thru to post. end synsacrum	134.7-143.2	129.3-135.5	132.6-146.3
Breadth across ant. iliac crests	82.4	79.9-83.0	85.8-92.8
Least ant. width	40.6-41.4	39.9-45.2 ^(39.0 M)	45.8-47.6 ^(40.0 M)
Ratio interacetab. to length	39.2%	40.6-37.4 ⁽²⁾	72.5-37.5 ⁽²⁾
Least ant. width	40.6-41.4	39.9-45.2	45.8-47.6

RATIOS OF PROPORTIONATE LENGTHS OF LIMB ELEMENTS
Based on Averages (in %)

Exms

	<u>Breagyps clarki</u>			<u>Gymnogyps californianus</u>			<u>Vultur gryphus</u>	
	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Min.
Humerus to wing ^a	36.4	36.2	35.8	38.5	38.45	38.4	37.6	36.5
Ulna to wing	44.6	44.0	43.4	42.6	42.55	42.5	43.7	43.4
Carpometacarpus to wing	19.6	19.4	19.0	19.0		19.0	19.9	18.6
Femur to leg ^b	28.7	28.5	28.1	29.0	28.8	28.2	27.9	27.6
Tibiotarsus to leg	47.3	46.8	46.7	46.5	46.3	46.0	47.1	47.1
Tarsometatarsus to leg	25.1	24.7	24.5	25.3	25.2	25.1	25.4	25.1
Humerus to wing ^a	36.4	36.2		38.4			37.3	
Ulna to wing		44.6		42.6			43.7	
Carpometacarpus to wing		19.5		19.0			18.9	
Femur to leg ^b		28.7		28.8			27.7	
Tibiotarsus to leg		46.8		46.3			47.1	
Tarsometatarsus to leg		24.7		25.1			25.2	
Estimated length of leg ^a	500.5	474.4	453.4	464.6	454.9	447.0	533.2	517.0
Estimated length of wing ^b	745.8	723.	704.4	716	705.8	697.0	769.5	740

a leg length based on maximum, minimum and mean lengths of femur, tibiotarsus and tarsometatarsus

b wing length based on maximum, minimum and mean lengths of humerus, ulna and carpometacarpus

c ratios based on average means

Estimated wing & leg lengths (mm) and proportions (in %)

Measurements of Carpometacarpus
(in millimeters)

	<u>Breagyps clarki</u> (14 bones)			<u>Gymnogyps</u> <u>californianus</u> (2 bones)		<u>Vultur gryphus</u> (2 bones)	
	max.	mean ^a	min.	max.	min.	max.	min.
Length from external trochlea to anterior face of distal end of metacarpal 2	145.8	141.5 ⁽¹⁴⁾	134.4	136.4 ^{134.8}	135.8 ^{132.0}	143.5 ^{140.1}	136.7
Length proximal symphysis to pisiform process	30.8	28.6 ¹⁴	26.9	31.3	31.1	38.0 ^{32.1}	26.3
Height process of metacarpal 1	15.9	14.3 ⁽¹⁴⁾	13.5	13.4	13.0	12.7 ^{12.5}	12.4
Length distal symphysis to distal tip of metacarpal 3	17.7	15.5 ⁽¹¹⁾	13.3	15.7	15.6	21.3 ^{21.0}	20.7
Ratio (in %) length proximal symphysis to overall length	21.9	20.1 ⁽¹²⁾	18.8	23.0	22.8	19.5 ^{19.4}	19.3
Ratio (in %) distal symphysis to overall length	12.3	11.0 ⁽¹⁰⁾	9.2	11.6	11.4	15.1 ^{15.0}	14.8
Ratio (in %) height of process of metacarpal 1 to overall length	11.2	10.1 ⁽¹²⁾	9.6	9.8	9.4	9.5	8.9

^a fig in () = no. of specimens

Ratio carpus to humerus	B. clarki	P. calif.	V. gryphus
max to max	51.8 or 55	49.5	52.5
mean to mean	53.6 or 54.4		50.3
min to min	52.6	50.4	
Ratio sternal length (containing) to symphysis			
max-max	320	330	302
mean-mean	311	343	315
min-min	309	352	329

~~ESTIMATED WING AND LEG LENGTHS (in mm) AND PROPORTIONS (in %)~~

ESTIMATED WING AND LEG LENGTHS (in mm) AND PROPORTIONS (in per cent)

Estimate	<u>Breagyps clarki</u>			<u>G. californianus</u>			<u>Vultur gryphus</u>		
	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean	Min.
Estimated length of wing ^a	745.8	723.0	704.4	716.0	705.8	697.0	769.5	740.0	721.7
Estimated length of leg ^b	500.5	474.4	453.4	464.6	454.9	447.0	533.2	517	500.8
Ratios ^c									
Humerus to wing		36.2			38.4			37.3	
Ulna to wing		43.4			42.6			43.7	
Carpometacarpus to wing		19.6			19.0			18.9	
Femur to leg		28.7			28.8			27.7	
Tibiotarsus to leg		46.7			46.3			47.1	
Tarsometatarsus to leg		24.7			25.1			25.2	

^aWing lengths based on maximum, minimum and mean lengths of humerus, ulnae and carpometacarpus.

^bLeg lengths based on maximum, minimum, and mean lengths of femur, tibiotarsus and tarsometatarsus.

^cRatios based on means

~~10 bones~~
Measurements of Coracoid
(in millimeters)

Copied

	<u>Breagyps clarki</u> 10 bones			<u>Gymnogyps californianus</u> 8 bones			<u>Vultur gryphus</u> 2 bones	
	Max.	Min.	Mean ^a	Max.	Min.	Mean	Max.	Min.
Length to sternal end mediad of angle	102.0	95.4	98.7(11)	98.9	92.9	96.4	104.0	96.9
Breadth across triosseal canal	21.8	20.3	21.2 ² (10)	23.1	20.4	21.6	23.2	20.7
Breadth furcular facet /	26.0	22.7	24.3(9)	26.2	22.9	24.7	31.6	27.5
Height furcular facet	15.2	12.6	13.5(11)	12.8	11.3	11.9	15.2	14.5
Ratio (in %) height to breadth of furcular facet	58.6	51.6	55.6(9)	51.5	45.5	48.2	52.7	48.1
Ratio (in %) breadth of furcular facet to triosseal canal	71.1	60.0	65.9(11)	59.7	50.7	55.0	70.5	65.6

^aFigure in parentheses indicates number of bones measured

Ratio (in %) breadth furcular facet to length of coracoid	26.6	24.6	23.7	26.4	25.6	23.5	30.3	28.2
Ratio (in %) breadth triosseal to breadth furcular facet to length	90.5	83.8	87.9	89.7	83.6	87.4	75.3	73.5
Ratio (in %) breadth triosseal to length	22.2	21.0	21.3	23.5	21.0	22.4	22.2	21.4

Buagyps clarki photos (negatives on file) 9695-96

F 3232 (~~Buagyps~~ ^{Coragyps} complete skull)

✓ B 3329 Prox end humerus (2 views) one on 9695-96, ~~then~~
 ✓ B 4447 Dist end humerus 1 view on 9695-96 on plate with one prox view

✓ B 5580 1/2 Femur (ext view) on 9695-96 with humerus 3329

Mandible (stymphylis)

Mandible articularis ^{distal view} on one negative

✓ B 4450

Scapula

Mandible art. (vent. view)

on one negative

B 3326

Tarsus B 3326

✓ B 1739

Coracoid B 1739

✓ B 1428

Sternum (lateral view)

in mt. photo avail.

✓ B 1428?

Sternum (ventral view)

✓ J 9402 1/2

Carpometacarpus, ext view

illus Miller 1925 pl 5 fig. C 1/10 as Cathartes ^{quadratus}

✓ B 5878

Tibiotarsus ext view

one negative

B 8311 or B 3326

Tarsometatarsus, int view

K 3158

Complete skull in mt

B 8311 or B 3326

Tarsometatarsus (ant.)

✓ B 1739

Coracoid int.

one negative

✓ J 9402 1/2

Carpometacarpus int. view

✓ B 5580 1/2

Femur ant. view

one negative

✓ B 5878

Tibia ant view

✓ B 2198

Cranium (2 views)

10734 neg.

illus Miller & Hoad 1938 pl 2 B, C

Same set of negatives has coragyps bones also all elements

Buagyo mt. ^{illus. Miller 1925 pl 5 fig AB x 1/10}

K3158 skull ^{illus. Miller & Howard 1938 pl 2a nat. size}

old # 1347 2 frags. low jaw

8308, 8309 - paracels.

H3837-B1495 coracoids

B1428 sternum ^{photo avail}

B5165, B4912 - Pelvis 2 pcs.

B3246 humerus T?

B1665, K3353 B592 B4458 max ulnar frags
max dist

B2667, B2181 carpo.

B4862, B7558 scap.

B3359, B3576 femora

B7026, B7746 - Tibia

B3111, B5533 tarsi

radius?



ZEE INFORMER

JULY, 1971

Wed	14	10:00	AM	Landmarks Committee Meeting (Dr. Kelsey)	Docent Lounge
			NOON	ALLIANCE LUNCHEON (Mrs. Fran Kellough)	Lounge
Thur	15				
Fri	16				
Sat	17				
Sun	18	2:30	PM	MUSIC PROGRAM - Louis Kaufman - Lucien La Porte Ensemble (Mrs. Myers)	Aud
Mon	19				
Tue	20		NOON	Special Meeting (Dr. Mead)	Lounge
		1:30	PM	SUMMER FILM SERIES - "AND NOW MIGUEL" 95 minutes - Color - (Mr. Lipscomb)	Aud
Wed	21	10:00- - NOON		SUMMER SALLIES (Mrs. Fran Kellough)	Aud/Lounge Av/Cr
		1:00-3:00	PM	SUMMER SALLIES (Mrs. Fran Kellough)	Aud/Lounge Av/Cr
Thur	22				
Fri	23	10:00 - - NOON		SUMMER SALLIES (Mrs. Fran Kellough)	Aud/Lounge Av/Cr
		1:00-3:00	PM	SUMMER SALLIES (Mrs. Fran Kellough)	Aud/Lounge Av/Cr
Sat	24				
Sun	25	2:30	PM	MUSIC PROGRAM - Lehwalder and Fields (Mrs. Myers)	Aud

Reprints 1 each of prints

- 1 neg skull - 1 complete
 2 negs cerebellum, int ($8\frac{1}{2} \times 11$) ant (4×5)
 3 negs tarsus ant ($8\frac{1}{2} \times 11$) pat (4×5) int ($8\frac{1}{2} \times 11$) = photo
 2 negs tibia ext ($8\frac{1}{2} \times 11$), ant ($8\frac{1}{2} \times 11$)
 2 negs carpometacarpal ext ($8\frac{1}{2} \times 11$), int ($8\frac{1}{2} \times 11$)
 2 negs femur ant ($8\frac{1}{2} \times 11$), ext (4×5)
 2 negs sternum vent (4×5) lateral (4×5)
 1 neg scapula vent. (4×5)

Photos
by Wm
Meekle
1935 or
1936

- 2 negs lower mand.
 art. & end (4×5) } same neg. 2 specimens; [art end ventral (4×5) sep. neg.]
 symphysis (4×5) }
 2 negs humerus } prox. humeral (4×5) [prox. palmar (4×5) sep. neg.]
 same neg. } (dist. palmar (4×5))

- 1 neg prox end ulna B 8310 left
 dist end ulna B 6914 left
 1 neg prox end radius B 6782 right
 dist end radius B 7661 right
 1 neg incomplete clavicle B 2224 left
 3 negs pelvis vent } B 1082 + B 1092
 pelvis lateral }
 pelvis dorsal }

Photos by
Lawrence Reynolds
July 1973

Meekle
 - Sternum ✓
 - Coccyx ✓
 - Scapula ✓
 - Humerus ✓
 - Femur ✓
 - Tibia ✓
 - Carpus ✓

Reynolds
 ulna ✓
 radius ✓
 clavicle ✓
 pelvis ✓

1p fig. 1 - sternum (full page) use lateral
 fig 2 - 2 views coracoid, + scap. (2 in of furcula extra)
 1p fig. 3 - palmar view - ^{humerus} prox B5329 + dist B4847 (full page)

→ fig 4 - ~~auricular view humerus prox (very dark)~~

1p. fig. 5 - int. view carpalula. + ant of femur
 1p. fig. 6 - auricular view hum. plus ^{plus} ~~ext~~ view prox + ant view dist

~~fig 4~~ lateral view clavicle, dist end ulna + prox ulna
 B2224 left B6914 left B8310 left
 " B766 right " B6782 right

1p fig. 7 pelvis B1092 lat.

1p fig. 8 pelvis B1092 + B1082 dorsal or ventral

Photos available - Brachyops

Sternum B1428 - lateral (R), ventral (specimen in mt)

Coracoid B1739 (R) internal, anterior

Scapula B4450 L ventral

Humerus B5329 prox R acromial, palmar } found to be
B4847 dist R ~~palmar~~ } prox + dist of same bone

~~Humerus radius~~

Carpometacarpus J9402 R internal + external

Ulna B5580 L anterior, posterior

Tibia B5878 R anterior, external

Tarsus B3326 L anterior, internal, posterior

Mandible OH#1344 R articular end ventral view + dorsal view

? ~~B1654?~~ symphysis (R) dorsal

~~Prox ulna~~

prox ulna B8310 ext + med left

dist ulna B6914 palmar view left

Left clavicle B2224 ext. view

prox radius B6782 B6782 right

dist radius B7661 B7661 right

pelvis B1082 + B1092 - dorsal, ventral + lateral views

Ulna prox B8310 left
Ulna dist B6914 ^{left} fig. 4
carpo. int J9402 right

femur ant B5580 left
femur ext fig. 8

sternum lat. figure 1 B1428 (mnt)

humerus palm. prox B5329 right
humerus palm. dist B4847 right } = prox + dist of same bone
figure 3

tibiotalus ant ^{to be} reduced fig. 9 B 5878 right
tibiotalus ext

pelvis dorsal fig. 6 B1082 + B1092

pelvis lateral ^{to be} reduced fig. 7

Coracoid int B1739 right
Scapula B4450 left fig. 2
coracoid ant. B1739
furcula B2224 left clavical

check this
? doubt author's fig. of scapula
no complete scapula now

radius prox B6782 right
humerus ant. prox fig. 5 B5329 right
radius dist B7661 right

left finer q. humerus ulna of carp, tibia of wrist, hum/uln, ulna to wrist
 Q. 141 128.1 269 297 135.8 701.8 38.4 42.3 110%
 mean gall 130.4 271.7 300.2 135.9 707.6 38.4 42.5 111
 V. 1734 148.4 157.8 280 337 380 143.5 240.5 251 760.5 36.6 44.3 120
 218 138.0 148.2 272.2 313 330 136.7 228.5 233 521.9 37.7 43.4 115
 Brea. max 139.5 149.7 267 333 343 145.8 225 233 754.8 35.4 45.4 128
 min 129.4 135.6 256 314 331 134.4 208.2 214 712.4 35.6 45.6 129
 mean 134.7 145.5 261 321 336 141.0 212 224 738 35.4 45.6 129

	Ratio cub/work	Ratio cub/hum.	Length synsac.	Length cristae	For sternum	Ratio length/stern.	Ratio cub. stern. to synsac.	Length synsac.	Ratio cub. stern. to synsac.
Q. 141	19.3	50.5	134.3	49.2	68.8	34.4	48.3	20.1	88.5
mean	19.2	50.2	142.6	49.2	68.8	34.4	48.3	20.1	88.3
V 1734	18.8	51.3	163.2	49.4	80.4	39.2	49.1	21.5	90.9 20
V 218	18.9	53.4	139.4	46.0	74.3	33.0	53.2	19.3	90.9 20
Brea. max	19.3	54.5	146.8	44.9	73.8	32.1	50.3	19.4	90.3 20
min	18.7	52.5	140.6	43.5	71.0	30.9	50.6	19.5	85.4
mean	19.1	54.0	143.2	44.9	72.7	31.4	50.7	19.4	87.3

	Ratio cub/hum.	Ratio cub/stern.	Length synsac.	Length cristae	Ratio cub/stern.	Ratio cub/hum.	Ratio cub/stern.	Ratio cub/stern.
Q 141	113.3	45.7	46.3	63.5	96.4	132.9	140.2	106.6
Q mean	114.7	45.7	46.3	63.5	96.4	135.2	141.1	104.0
V max	133.8	49.1	64.5	96.9	143.0	142.2	141.2	98.0
V min	127.7	49.1	64.5	96.9	142.2	141.2	141.2	98.0
Brea. max	125.7	49.0	64.0	90.2	136.8	142.2	142.2	104.2
min	110.4	44.8	62.5	95.4	134.9	141.2	141.2	104.0
mean	117.8	46.4	62.9	98.7	136.2	142.9	142.9	104.7

	Ratio cub/hum.	Ratio cub/stern.	Length synsac.	Length cristae	Ratio cub/stern.	Ratio cub/hum.	Ratio cub/stern.	Ratio cub/stern.
Q 141	81.0	29.4	26.7	26.1	55.7	37.7	32.6	121.9
Q max	78.2	28.9	25.5	24.7	58.0	37.2	30.9	123.0
Q min	75.7	28.2	25.5	24.7	58.0	37.2	30.9	123.0
V max	83.3	29.7	24.7	24.9	56.9	35.3	30.9	124.0
V min	74.9	28.6	24.9	24.9	56.9	35.3	30.9	124.0
Brea. max	78.9	29.5	23.0	24.1	54.1	38.2	29.8	129.0
min	72.8	28.4	22.2	24.3	54.3	37.8	29.4	130.8
mean	75.9	29.4	22.5	24.7	53.7	36.2	29.2	130.0

12 | 134 1150
 12 12 12

III III

III

sternall
to coracoid
length

Brachypt
max m min
46-45.6-45.6

9. caly
51.4 50.9 51.2

Vulture 313
337
47.4 47.6 245.0
325

Coracoid length 36.3 37.4 } 37.4
to humeral length 38.5 38.2 }

35.9, 35.5 34.5

35.6-37.2

sternal
breadth cora. 72.4-73.6-74.5
length

73.8-71.6-71.7

broader sternum or slender
77.3-76.6 cora.

sternal to
sternal length 157, 162, 163

143, 141, 140

broader sternum
162, 161

carpal length 55) 54.4) 52.4
to humerus 51.8) 53.6

50.4 49.5

51.5 50.3

talus to
femur 90.7 88.3 89.7

141 88.5

90.6
longer femur, 11
104 101 134 135 135.5

femur to
carpus 95.8 95.6 96.0

98.7 93

30.2 33

sternal
length to
pelvic length 32.1 31.2 31.5

33.3 34.4 35.3

72.6 71.0

coracoid length
to carpal length 70.0 70.2 70.9

72.6 71.0 68.5

length
femur to
length humerus 49.6 51.2 50.6
52.6 52

48.8 48.2 47

52.9 50.8

carpal
coracoid 143 143 141.1

144 141

137.9 140.0
141.5

femur to
fibula 62.0 63.5 62

63.1 62.2 60.5

60.5 60.4

carpal to
ulna 42.5 42 41.1

44.9-45.6

43 43.6

humerus
ulna 82.2 77.2 77.7
77.5 78.3

90.7 90.2 90.7

83.6 87.0

Carpa
143.5
136.7
V ulna
33.7-
33.3-
280
272

With respect to size Breagys clarki
appears to have been ^{averages slightly} larger than Gymnogyphus
californianus ^{and} ~~but~~ smaller than G. amplius
or Vultur gryphus. The humerus, however,

was ~~relative shorter~~ than in any of these other
Carnivora species and actually shorter even than
in G. californianus. ^(see table) No complete ulnae or radii
of Breagys are available but estimates based
on incomplete ulnae suggest that the ^{ratio of} humeral
~~was~~ to ulnae length was from 74.5-77% ^{in Breagys} whereas
in Gymnogyphus (both species) the ratio ~~was~~ 87-90%
and in V. gryphus 83-87%. ~~Proportions~~

~~On body proportions, the short broad sternum of~~
Breagys compared to the ^{rel.} ~~longer, narrower sternum found~~

~~in both species of Gymnogyphus suggest that Breagys~~
~~was a~~ Breagys resembled Vultur in the short
broad sternum. The length of the costal row in both
Breagys & Vultur averages less than in G. calif.
But the breadth ~~is~~ averages greater even than
in G. amplius.

98.9) 73.1
73.1
69.23
3070
2967
1030

Rel. length carp. to humerus				Ratio	carp. hum	Hum	length	Ratio to Hum	carp
Gymnophis	141	hum. 269	carp. 136.0	-	50.6	Hum	128.3	47.6	94.2
	"	269	hum. 275	carp. 136.4	-	"			
Vultur	1734	hum. 280	carp. 143.5	-	51.2		148.4	53.0	103.90
	218	"	272	carp. 136.1	-	"	138.2	50.8	101
Pneapys		maxs hum	260	carp. 145.8	-	56.0	Hum. 139.4	53.6	96.0
		mins "	256	" 134.4	-	52.6	129.0	50.4	96.1
		mean "	258.5	" 141.0	-	54.4	134.8	52.0	95.5

Brachycephalus compared to <i>g. calid.</i> & <i>v. gryllus</i>			Ratio <i>g</i> to <i>v</i>
Ratio means	to <i>g</i> .	to <i>v</i>	
sternal br.	105.90	92.5	89.30
costal row	91.690 ✓	94.0	102.7
Scapula br.	105	107 ✓	105.90
acrom length	105	91.5	85.6
Coracoid length	102.4	98	96.2
br below	103.4	102 ✓	98.7
Humerus length	97.3 ✓	93.0 or 95	98.3
bicip br.	104	97	93.3
dist br	102	95	92.7
Pelvic symph.	99.5 ✓	93.5	94.1
Femur length	103	94	91.1
Tibia length	101	90	89.5
dist	100	94.8	94.0
Carpus length	104	100.8 ✓	96.5
MM 1	110	114.7 ✓	97.0
Ratio prox. length	88 ✓	103 ✓	117.5
" dist "	95.4 ✓		90.4
Tarsus length	102	93.7	

g. humeri means for length 269 largest
141 smallest

Tarsus

Brach 110.7 - 125.6 MM 117.3

g. 113.3

v 125.3 (min.)

g #371 and 1052 largest femur
31 & 141 smallest "

two 31 smallest & largest coracoid & scapulae
1052 small coracoid
141 average "

371 largest scap, 302 large scap

Brachycephalus overlaps *v* in length costal row (0.9)
br. scap (7.6)

1050

#?

length for 371 but has
g. smaller

g. carpi 141 and 269

In br. scap and carpal length only

max *g* B exceeds max *v*

In length costal row B max ^{+ mean} *g* min

In length humeri B mean is below *g* min

Table 10

Comparison of Lengths of Wing and Leg Elements
(Measurements in millimeters; ratios, in %, based on mean lengths)

	<u>Breagyps clarki</u>			<u>G. californianus</u>			<u>Vultur gryphus</u>		
	max.	mean	min.	max.	mean	min.	max.	mean	min.
Humerus	267	261	256	275	271	269	280	276	272
Ulna	¹²⁷ 341	¹²⁷ 331	¹²⁵ 321	¹¹⁰ 303	¹¹⁰ 300	¹¹⁰ 297	¹²⁰ 337	¹¹⁷ 324	¹¹⁵ 313
Carpometacarpus	²³⁴ 146	²³⁴ 141	²³⁹ 134	²²³ 136	²²³ 135.5	²³¹ 135	²³⁴ 143	²³¹ 140	²²⁹ 137
Total of three elements (wing length)	754	733	711	714	⁵ 706.5	⁶⁹⁷ 701	⁶⁰ 750	¹ 740	722
Femur	141	136	129	135	131	126	143	143	138
Tibiotarsus	²²⁵ 233	²¹⁶ 223	²⁰⁹ 214	213	210	208 ^a	²⁴⁴ 251	²³⁵ 243	²³⁰ 236 ^{slit}
Tarsometatarsus	126	117	110	117	114	113 ^a	134	130	127
Total of three leg elements (leg length)	500	476	453	465	455	447	⁵²⁶ 533	⁵¹⁸ 516	⁴⁹⁵ 501
ratio leg & wing	^{66.3%} 35.4	^{64.4} 35.6	^{63.7} 35	^{65.1} 38	^{64.4} 38.4	^{64.1} (38.6)	^{70.9%} 36.9	^{70.1%} 37.3	^{69.5%} 37
Humerus: wing									
Ulna: wing	45.3	45.2	45.2	42	42.5	(42.2)	43.4	43.8	43
Carpometacarpus: wing	19.3	19.2	19	19	19.0	(19.1)	18.84	18.9	18.9
Femur: leg	28.2	28.6	28.4	28.4	28.8	(28.6)	28.1	27.7	28.1
Tibiotarsus: Leg	46.4	46.8	46.4	46	46.1	(46.4)	46.4	47.1	47.1
Tarsometatarsus: Leg	25.2	24.6	24.4	22.5	25.1	(24.8)	25.1	25.2	25.5

a

Measurements from Fisher (1947:233), one now available measurement for tarsus
150 153 157 153 153 157 155 142 143 146
150 153 157 155 217.5 for tarsus
217.5 for tarsus

Do not use this table. It is based on measurements that vary too much from species to species (i.e. Fisher's measurements on 1 or 2 bones or good series.) Refer to rough averages of measurements

138

192

139

129 193
127

Fossil

Breagyps clarki

(LACM catalog numbers)

Sternum: six incomplete, B1517, B3071, B3372, B3783, B4554, B5669.

Furcula: one symphysis, B6035; four clavicles, B2224, B2601, B8114, B8315.

Coracoid: nineteen nearly complete, B1499, B1638, B1739, B2311, B2644, B3242, B3424, B3821, B6188, B6320, B7067, B7124, B7479, B7699, B7743, B7842, B7914, B8039, B8376.

Scapula: one complete, B4450; ten articular ends, B1657, B1670, B1671, B1676, B2 59, B3420, B3402, B4418, B6020, B6332.

Humerus: four nearly complete, B4847+B5329, B7730, B7737+B7739, B9002; five proximal ends, B1583, B2083, B2156, B4954, B5917; three distal ends, B2034, B5956, B7247.

Ulna: nine proximal ends, B1859, B1910, B3838, B4221, B4630, B6912, B6925, B7248, B8310; five distal ends, B3453, B5891, B6914, B7503, B7715.

Radius: one proximal end, B6782; one distal end, B7661.

Carpometacarpus: fourteen nearly complete, B1075, B1755, B2168, B2632, B3154, B3271, B3625, B4160, B4375, B5331, B6395, B6712, B7608, J9402.

Pelvis: one nearly complete, B1082+B1092; five incomplete, B1635, B3346, B6859, B6865, B7895.

Femur: eight nearly complete: B1404, B3358, B4989, B5530, B5693, B6259, B7493, B7803; two incomplete proximally, B2599, B6910; two proximal ends, B2257, B6372; six distal ends, B1437, B1574, B3388, B5950, B6620, B7460.

Tibiotarsus^{ws}; three nearly complete, B4039, B5878, B6413+B6414; one incomplete proximally, J9629; four proximal ends, B2115, B2314, B3361, B6404; nine distal ends, B1074, B1593, B2116, B3383, B5156, B6477, B7085, B7244, B8313.

Cervical vertebrae: B3841, B3945, G9423, G9346 (atlas).

Additional specimens of these elements were used in the composite mount of Breagyps clarki now on exhibit at LACM: sternum B1428; furcula B8308+B8309; coracoid B1495, H3837; scapula B4862, B7558; humerus B3246; ulna, proximal end B4458, K3353, distal end B592, B1665; carpometacarpus B2181, B2667; pelvis B4912, B5165; femur B3379, B3576; tibiotarsus B70~~8~~26, B7746. For an illustration of this mount, see Howard (1962: 29, fig. 12).

Comparing ~~the~~ combined lengths of leg elements to combined lengths of wing elements, V appears to have relatively longer legs. B & G, are very nearly alike in the ^{proportions}

It is difficult to make direct comparison of ^{body sizes} ~~the~~ proportions of ~~the~~ the separate elements of wing and leg of the fossil animal and the two modern condors. ~~There are~~

~~two~~ ^{in general} ~~few~~ specimens. The number of specimens varies greatly depending on the element. ^{The one hind femur and 2 femora} Fisher's (1946) measurements of ~~specimens~~ ^{of this meas} can be used in part but the ~~portion~~ ^{area encompassed} may not be the same as can be ~~seen~~ taken on the fossil specimens.

~~At~~ Rough estimates of the ratios (in %) of wing & leg elements ^{with 3 sp} are shown in Table 10

	B. & G.	G. calif	V. gryphus
ratio leg length to wing length	65%	64%	70%
ratio hum to wing length	36	38	37
ratio ulna to wing length	45%+	42	44
ratio carpus to hum length	19+	18.9 19-	19-
ratio femur to leg length	29	29	28
ratio tibia to leg length	47	46	47
ratio tarsus to leg length	24	25	25

rough estimates suggest that the humerus to wing length (ie, combined length of humerus & wing) is least in *B. & G.*, slightly less in *V.* & least in *G.*. The comparison of wing length ratios is very nearly the same in the 3 species. The ratio of femur to leg length is very nearly the same in the 3 species. The ratio of tibia to leg length is very nearly the same in the 3 species. The ratio of tarsus to leg length is very nearly the same in the 3 species.

Although ~~exact~~ comparison of proportions within the limb elements cannot be exact in view of the ^{disparities in} ~~variations in~~ number of ^{specimens} ~~available~~ ^{per element} ~~available~~, ^{averages} ~~rough estimates~~ ^{shown} are given in Table 10.
 This ~~table~~ ^{table} shows no consistent ~~relationship~~ ^{relationship} between wing length = combined lengths of humerus, ulna & femur; tarsus & femur; wing length = combined lengths of humerus, ulna & femur, ^(B. & G.) ~~from~~ ^{from} ~~from~~

218
213
208
210
4849
212

131
~~135~~
~~132~~
136
135
9)535
134

457

320
305
313
320
315
312
6)1885
314

ulmam 314
carpe
huv

295-
134-
269-
698
42.8%
19.8%
38.6%
5

188
190
19
3)568
189

244
280
2)476
235

533
501
2)1034
517

275
271
269
274
262
267

495
526
2)1021
510

138.5
210
114.7
463.2
138.5
9964
45860

38.5
698)269.0
2094
5960
5584
3760
3490
2700
2.2

698)29570
2792
1580
1396
1840
19.2

698)134.0
698
6420
6282
1380
1396

6)1618(269
12
41
36
58
2)1482
741

266
308
132
706

754
5000
4524
4960
4524
2360

711)4530
4266
2640
2133
5070
63.7

733)476.0
4398
3620
2932
6880
64.9

697)4470
4182
2880
2788
920
64.1

706)4550
4236
3140
2824
3161
64.1

701)4470
4206
3640
65

8
803
585
468
32

760/5330
722
5010
5054
7

	Length	Wing	Carpus	Wing	Wing	Tarsus	Leg	Wing	Wing	Wing	Wing	Wing	Tarsus
	Heimer												
calharts	18	142.5	167 (174.4)	82.8	397.3	46.1	115.1 (116.9)	63.5	244.9	61.5	37.2	42	20.8
San	737	172.5	193 (203.6)	87.0	452.5	94.9	160.6 (165.5)	96.0	350.9	77.5	38.2	42.7	19.2
con	716	135.3	146 (158.0)	76.9	358.2	83.5	140.8 (143.8)	86.1	310.4	86.8	37.8	40.6	21.4
1739	140.6	149.7 (161.0)	78.3	368.6	85.4	141.6 (144.3)	84.7	301.7	84.5	38.1	40.5	21.2	118
													155
													143

135	140	160.6	172.5	135.3	83.5	85.4	140.6
146	179	96	193	146	140.8	141.6	149.7
75	79	949	87	769	86.1	84.7	78.3
358	368	3515	452.5	3582	3104	3117	3686

out 1000
B6865
5300-5309

Pelvis - 1 complete (B 1082 + 1092)

5 unc. B1635, B6859, B7895, B3346

Sternum ^{nearly comp. in mt B1428} 1 incomplete B5669, B3372, B4554, B3071, B1517, B3783

Manubria 5 incomplete B6035, B2601, B2224, B8114, B8315

-1 Coracoid 19 nearly complete B3242, B1739, B1638, B1499, B8376
[B1879 prox] B7067, B6188, B3821, B6320, B7847
B7124, B2311, B7699, B7479, B7914, B8039
B3424, B2644

B7743
also in old
list where is it?

B4450
Right rib left
(left in m5)
RIGHT
NOT LIST

Scapula 11 artic. ends B1676, B3482, B4450, B1671, B3420
B6020, B1657, B2759, B4332, B4718, B1670
OR 22 478

Humerus 4 nearly complete B7730, (B4847 + B5329) B8002, (B7739 + 7737) one bone
5 prox. B2083, B4954, B1583, B5917, B2156
3 dist. B2034, B7247, B5956

Ulna 9 prox B4430, B7248, B6912, B1859, B8310, B4221
B1910, B3838, B6925
5 dist B7715, B6914, B3453, B5891, B7503

Radius 1 prox B6782
1 dist B7461R

B3154 where is it?

-1? Carpometacarpus 14 nearly complete B2168, B3371, B9402, B6712
B5331, B1755, B3625, [B349 dist.]
B6395, B4375, B2632, B7608, B1075, B4160

check
carpo 3271?
B1075?
B4160?

Femur 9 nearly complete B1404, B3358, B5693, B7493, B6259
B4989, B6910, B4803, B2599 (uncertain) - dist

where
is B5580 (ulna)?

2 prox B6372, B2257
8 dist B1437, B7460, B6620, B3388, B1574, B5950, B6938

Tibia 4 near comp. B6414, B403, B5848
4 prox B6404, B5797, B2115, B2374, B3361
9 dist (19629) B7951, B3383, B1246, B5156, B10744, B1593, B6477
L near comp. B7085, B8313, B7244

check
very tibiae
inc

Vert. 4 cervical B4425, B3841, B3437, B3945

other
cervical vertebrae
B4425
B3945

G9423 - This one described but check no.
G9346

axis - lost G9346

Condor (~~Breagys~~) mt.

~~Y~~ *Tricula* 8308, 8309

✓ Ceracoids H 3839, B 1495

✓Stemmen B 1428

✓ Pelvis B5165 + B4912

✓ Humerus B3246 and ? frags #?

✓ Ulmace frag. B 1445, K 3353, B 4458 B 592
dist pur pur dist

✓ *Caipometa*. B2667 + B2181

✓ Scaps B4862, B7558

✓ Femora B3379, B3576

✓ Tibial B7026, B7746

Tarsi B3111, B5573

Atlas B 47⁵₈

Axió H 1533

14 Cervicob. B7394, B3508, B4753, B8129, B5404
B2327, B2528

B4465, B7129, B5122, B2327, B2528

B5547, B5552, B4950, B2486

5 Thoracica B317, B4029, B4934, B2126, B4933